UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service

COMPUTATIONAL TABLES FOR USE IN STUDIES OF ARTIFICIAL DAYLIGHTING

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The tables in this report are those used in artificial daylighting studies made during the last several years in the color measurements laboratory of the Agricultural Marketing Service. Two reports on this work have been published 1/ 2/ and a third report, prepared for presentation to the Illuminating Engineering Society, has been accepted for publication. 3/

The practical result has been the installation of Macbeth 7500K units of artificial daylighting in the larger cotton classing rooms of this Service, units similar to the one shown in figure 1. Smaller units of this sort are being used for other color grading purposes, as in the grading of flour color in bread and macaroni, figure 2, and lamps of the same type, but without diffusing glass, figure 3, are used when needed for grading canned fruits and vegetables in the laboratories of this Service.

These tables are published, not only to make available the data upon which our own conclusions were based but in order that other workers who may be interested in illuminants not included in this study, or in products not studied, may be able to use much of the same basic data in calculations involved in their own studies. By such use they can save themselves much work by being able, upon completion of their computations, to compare their results with those already obtained for the illuminants and standards used in studies made by the author. 3/ Sources of original data for these illuminants are given in an early publication. 1/

1/ Nickerson, Dorothy. Artificial Daylighting for Color Grading of Agricultural Products. Jour. Optical Soc. Amer. 29: 1-9. Jan. 1939.

2/ ---------- Artificial Daylighting Studies. Illum. Eng. Soc. Trans. 34: 1233-1253. Dec. 1939.

3/ ---------- The Illuminant in Color Matching and Discrimination. How Good a Substitute is One Illuminant for Another. Illum. Eng. 35: (For Sept. 1940 issue).

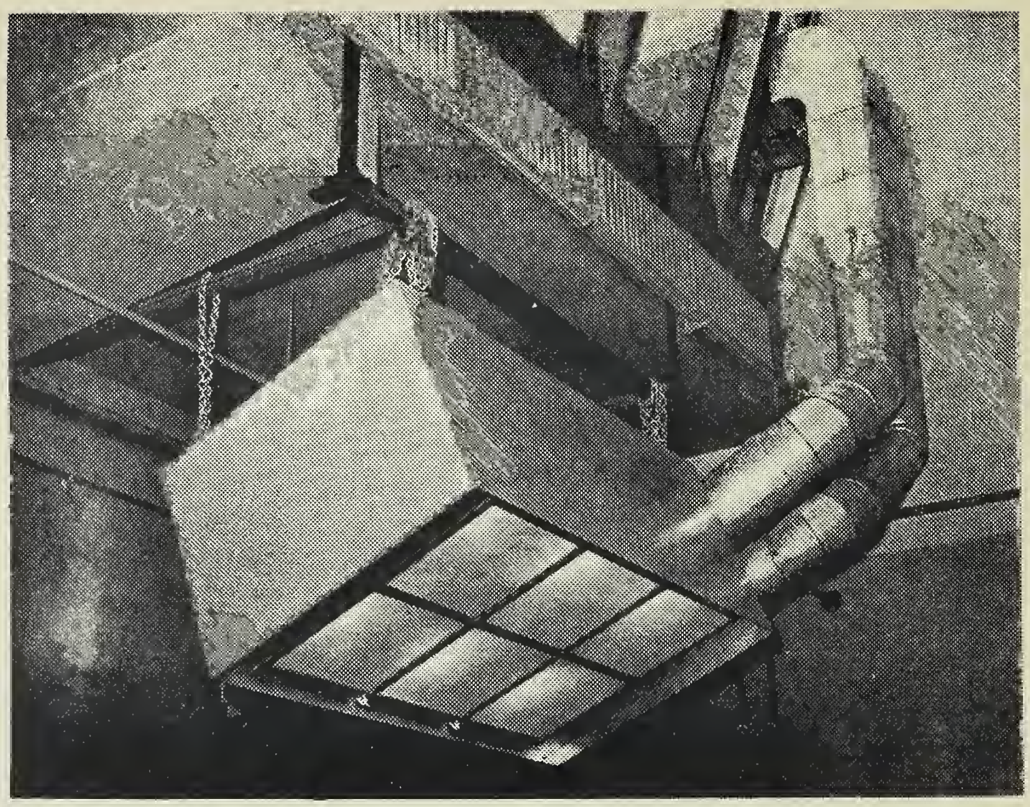

Figure 1. — Macbeth artificial daylight unit developed for use in cotton classification. This unit is ventilated by forced draft.

Figure 2. — Smaller unit similar in quality of light to that produced by the unit in figure 1.

Figure 3. — Lamps similar in quality of light to that of units shown.

Certain of the symbols used in these tables are intended to follow the usage of Judd 4/ in his paper describing the 1931 ICI standard observer and of Hardy 5/ in his Handbook of Colorimetry.

The following statements may help to clarify the relations of the several symbols:

Symbols X, Y, Z are used to represent any tristimulus specifications which are based on the 1931 ICI standard observer.

Symbols $\bar{x}$, $\bar{y}$, $\bar{z}$ refer to a specialized case of X, Y, Z. They should be used only to refer to distribution coefficients for equal energy stimulus for the 1931 ICI standard observer. They are the tristimulus values for one unit of spectrally homogeneous radiant energy of wavelength λ.

Symbols x, y, z represent fractional values which may refer either to the special case $\bar{x}$, $\bar{y}$, $\bar{z}$, or the more inclusive X, Y, Z values. Although these symbols are often referred to as trichromatic coefficients, they more properly could be, and often are called trilinear coordinates. Regardless of the values assigned to X, Y, Z, the values for x, y, z must always total 1.0. They are the values used for plotting on an ICI diagram.

Symbols for x, y, z subscripts:

x_w, y_w, z_w, as used by both Judd and Hardy refer to x, y, z values for an illuminant.

Other subscripts are not used generally, but may be used in specific instances. In such cases their meaning should be explained clearly in the text, as has been done by Hardy in x_1, y_1, z_1 to refer to x, y, z values of the spectrum locus when reference to x, y, z values of an illuminant (x_w, y_w, z_w) and of a test sample (x_s, y_s, z_s) in the same text would have been confusing without the use of subscripts.

For the information of those who would like to have the determinations of the tristimulus values in mathematical terms, reference should be made to the Hardy handbook. 5/ Briefly:

$$X = \int_0^\infty ER\bar{x}d\lambda$$

$$Y = \int_0^\infty ER\bar{y}d\lambda$$

$$Z = \int_0^\infty ER\bar{z}d\lambda$$

4/ Judd, Deane B. 1931 ICI Standard Observer and Coordinate System for Colorimetry. Jour. Optical Soc. Amer. 23: 359-374. 1933.

5/ Hardy, A. C. Handbook of Colorimetry. Cambridge, Mass., Technology Press, 1936. 87 pp.

and this is approximated by summing for $\Delta\lambda$ intervals (either at equal wavelength intervals or for selected intervals) the values of $ER\bar{x}$, $ER\bar{y}$, $ER\bar{z}$, when E represents the energy of the illuminant, R the reflectance or transmittance factor of the material under test, and $\bar{x}$, $\bar{y}$, $\bar{z}$, the tristimulus values of the ICI standard observer (as defined above).

Since 1931, it has become the usual practice to use the above symbols in referring to the ICI standard observer and coordinate system. [4]

Symbols R, G. B — When coordinate systems other than ICI are used, it is general practice to use R, G, B (or $\bar{r}$, $\bar{g}$, $\bar{b}$ used as equivalent) for the tristimulus specifications.

Symbols r, g, b — represent fractional values of R, G, B; -- the trilinear coordinates for R, G. B.

These, for example, are the symbols used by Judd in referring to his uniform chromaticity scale (UCS) system. When several coordinate systems are referred to they can be distinguished by subscripts, as R_u, G_u, B_u for tristimulus values for the UCS system; R_o, G_o, B_o for tristimulus values for the OSA system (widely used in this country prior to 1931); etc.

TABLES

The tables are listed below by title with whatever explanation has seemed necessary in order to understand their meaning. This report has been prepared as a companion to the author's recent study on illuminants [3] and therefore reference to the text of that study should be made whenever it may seem that there is insufficient explanation in this report. The 12 figures and 2 tables in that study are based upon data given in the tables found at the end of this text.

Table 1: Illuminants and standards used in artificial daylighting studies. Page 11.

It should perhaps be noted, in order to avoid any possible misinterpretation, that the use of an illuminant to represent the mercury lines has nothing at all to do with the fluorescent light from which the data were taken except insofar as the computations are involved. Because computations made for fluorescent light included data for mercury lines and for a smooth curve low in both the red and blue ends of the spectrum, it was very little extra work to make the summations necessary to include illuminants representing the mercury tubes of peculiar color characteristics, with which

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See footnote 4, p. 3.

See footnote 3, p. 1.

most every one is acquainted, and an illuminant of the characteristic curve that would be found by using the smooth portion of the fluorescent curve for 7650K. Every one is familiar with the marked color changes in the daylight color of materials seen under a mercury light. Therefore, the presentation of figures representing comparisons of samples under mercury illumination with samples under daylight illumination is included in order to provide an extreme case of expected color change. The smooth portion of the fluorescent-type curve is used for a similar reason, the curve in this case being low in both red and blue. The results for the mercury lines and for the curve portion of the fluorescent data, when they are used to represent separate illuminants, have nothing to do with results for fluorescent-type illumination.

The series of curves called "Gibson" in this paper and in the author's report on color matching and discrimination [3] represent curves described by Gibson at the 1939 Lake Placid meeting of the Optical Society of America. Each curve represents a different proportion of skylight (calculated by the use of the inverse λ^4 scattering relation) and sun-outside-the-atmosphere (Abbot data). The parenthetical subscripts refer to the proportions of skylight and Abbot daylight in each curve. For example, Gibson $1/\lambda^4$ (.3 + .7) represents a curve made up of .3 skylight and .7 Abbot sun-outside-the-atmosphere.

The 18 illuminants in this table are listed according to micro-reciprocal degrees of color temperature (μrd's, or mireds). This seems a more useful way of reporting them than by color temperature itself, especially if one will remember that different phases of blue sky range from 0-100, "C" illuminant is about 150, "B" illuminant about 200, and "A" illuminant about 350.

Table 2: Spectral energy distribution data for standards and illuminants listed in table 1, with certain supplementary data. Pages 12-13.

These data are adjusted relative to 100 for wavelength 560 mμ. They are given for 10 mμ intervals, plus data for the 4 wavelengths representing the wavelength position of the mercury lines (to the nearest mμ).

See footenote 3, p. 1.

Table 3: Computational table for ICI Illuminants "B" and "C" Page. 14.

The data in this table are taken from the report of the "1931 ICI Observer and Coordinate System for Colorimetry." 4/

In addition to totals for 380-770 mμ given in the Judd paper, those for 400-700 mμ are given here. The Y values for 400-700 mμ data may be adjusted so they can be used to represent 100 percent reflectance by multiplying by the reciprocal of the Y totals for 400-700 mμ.

In tables 4-11 the values are totaled so as to give this figure directly. This has been done because 400-700 mμ is the wavelength range generally used on the G.E. recording spectrophotometer, and the bulk of spectrophotometric measurements today are obtained on that type of instrument. The ICI "B" and "C" curves have been kept as reported by Judd in order that there be no confusion of slightly different figures. Obviously, data should be calculated to 380-770 mμ limits whenever they are available. Computational data for equal energy and for ICI "A" are included in the Judd report noted above.

It will be noted that the number of places to which computational data are carried varies for different tables (3 through 11). The figures in these tables should be carried far enough so that there will be no numerical difference in the last place deemed significant for the trilinear coordinates. Because many of the differences with which we are dealing in these computations are very small, they were set up, insofar as possible, to provide data that could be carried to a fifth decimal place. Certain of the data are carried more than enough places for that. Had we known when this work was begun all we do about it now, or had we then expected to publish these computational tables, all work would have been handled in the same manner, and carried to the same number of places. But since they actually were carried to a different number of places in the course of our computations, they are reported that way. Thus, any future calculations made with these figures should be comparable with our results. If one uses a calculator, it is generally no more difficult, except in the additions, to carry the figures an extra place or two. If trilinear coordinates are needed only to three or four decimal places, then fewer places need be used in computation. But work cannot be done with an ordinary slide rule, except to arrive at a very approximate result. Work of this sort should be done carefully and accurately, and carried to a sufficient number of decimal places.

See footnote 4, p. 3.

The values given in this table at the mercury lines are adjusted so that multiplications can be used for data at the wavelength indicated, yet be added to the totals for the smoothed portion of the curve which has been summed for intervals of 10 mμ. The numbers for the mercury lines refer to energy (in a 10 mμ interval centered on each mercury line) which is in addition to that included in the smoothed curve.

Refer to discussion under table 4.

Refer to discussion of table 1 in the text for explanation of Gibson curves.

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For a discussion of the use of micro-reciprocal degrees of color temperature for specifying the chromaticity of various phases of daylight, reference should be made to Irwin G. Priest's article, Proposed Scale for Use in Specifying the Chromaticity of Incandescent Illuminants and Various Phases of Daylight, Jour. Opt. Soc. Am. 23: 41 (1933). If the proposal made by Priest were followed the use of micro-reciprocal degrees of color temperature would become more general than the use of color temperature.

Table 13: Spectral apparent reflectance data for 8 pairs of samples selected for use in studying various illuminants. Page 23.

These include 4 pairs of samples selected for study by Judd. Curves representing the 8 pairs of colors are shown in figures 5, 7, and 11 of the paper on "The Illuminant in Color Matching and Discrimination." [3]

Table 14: Spectral apparent reflectance for 30 cotton samples selected for use in studying various illuminants. Page 23.

Of these samples nine were selected for use in pairs. They are: Pair 1, numbers 401 and 402; Pair 2, numbers 411 and 412; Pair 3, numbers 808 and 809; Pair 4, numbers 430 and 530; Pair 5, numbers 430 and 630. Curves for these pairs are shown in figure 9 of "The Illuminant in Color Matching and Discrimination." [3]

For the spectral apparent reflectance curves of these cotton colors, as well as 4 of the colors used in table 13 we wish to thank Walter C. Granville of the Interchemical Corporation Laboratories. On many color problems, the cooperation given us by the laboratories of the Interchemical Corporation has been invaluable.

Table 15: Formulas for converting ICI values for $\bar{x}$, $\bar{y}$, $\bar{z}$ to UCS values for $\bar{r}$, $\bar{g}$, $\bar{b}$. Page 24.

By these formulas the 1931 ICI standard coordinate system may be converted to a coordinate system found by Judd on trial and error to yield the best agreement with chromaticity sensibility. For convenience the new coordinate system proposed by Judd is referred to as a uniform-chromaticity-scale (UCS system). The formulas appear in a paper by Deane B. Judd, A Maxwell Triangle Yielding Uniform Chromaticity Scales, Jour. Opt. Soc. Am. 25: 24 (1935).

Table 16: Differences in reflectance (ICI - Y values) and chromaticity (in UCS units of r, g, and b) for 4 pairs of colors selected by Judd, as calculated for 15 illuminants. Page 25.

A chart of these differences, arranged inversely according to the color temperature of the illuminants, is contained in figure 6 of "The Illuminant in Color Matching and Discrimination," [3] and curves of spectral reflectance of the pairs used are contained in figure 5

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[3] See footnote 3, p. 1.

of the same report.[3/] The 0 point from which the differences in figure 6 [3/] are plotted is taken at or near the low value for each column of figures in this table.

Table 17: Differences in reflectance (ICI - Y value) and chromaticity (in UCS units of r, g, and b) for 2 pairs of colors selected for calculation under 10 illuminants. Page 25.

A chart of these differences is contained in figure 8 [3/] and curves of spectral reflectance for the pairs used are contained in figure 7. [3/] The 0 point from which the differences are plotted in figure 8 [3/] is the low point of each column in this table 17.

Table 18: Differences in reflectance (ICI - Y value) and chromaticity (in UCS units of r, g, and b) for pairs of tobacco and coffee colors calculated for 4 illuminants. Page 25.

A chart of these differences is contained in figure 12 [3/] and curves of spectral reflectance for these pairs are contained in figure 11. [3/] The 0 point from which the differences are plotted is at or near the low point of each column in this table.

Table 19: Differences in reflectance (ICI - Y value) and chromaticity (in UCS units of r, g, and b) for 5 pairs of cotton colors. Page 26.

These pairs are selected from the 30 cotton colors listed in table 14. The pairs are listed in the discussion of that table in the text. A chart of these differences is contained in figure 10 [3/] and curves of spectral reflectance for these pairs are contained in figure 9. [3/] The 0 point from which the differences are plotted is the low point of each column in this table.

Table 20: (5 pages) Mean differences, caused by changing from one to another of 17 illuminants, for reflectance (ICI - Y value) and chromaticity (in UCS units of r, g, and b) for 30 cotton colors. The standard deviation is shown with each mean. Pages 27-31.

If one illuminant is a perfect substitute for another the mean differences for a representative set of colors would be 0, with 0 variation (as represented by the standard deviation). If an illuminant shifts

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See footnote 3, p. 1.

all colors in exactly the same relation, the means might differ, but the variation, as represented by the standard deviation, would remain 0. Table 2 of the study on "The Illuminant in Color Matching and Discrimination"3/ has been prepared from the standard deviations shown in this table 20. The standard deviations of these differences about the mean have been used an an inverse measure of the degree of duplication between any trial illuminant and a standard illuminant.

See footnote 3, p. 1.

If the reader finds any error in these tables it will be much appreciated if he will immediately notify the author at Agricultural Marketing Service, Washington, D. C.

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August 31, 1940.

Table 1. Illuminants and Standards Used in Artificial Daylighting Studies. (Same as table 1 in (3))

Order	Identification	Approximate color temperature in μrd	ICI trichromatic coefficients based on ICI values for equal energy	
			x	y
1	Mercury lines of $\text{Fluorescent}_{7650K}$	Beyond 0	0.2190	0.2288
2	$\text{Fluorescent}_{13000K}$	77	.2679	.2760
3	CO_2 (25mm)	110	.2820	.3104
4	Gibson $1/\lambda^4$ (.3+ .7)	110	.2854	.2912
5	Gibson $1/\lambda^4$ (.2 + .8)	125	.2959	.3029
6	Planckian_{8000K}	125	.2952	.3051
7	$\text{Fluorescent}_{7650K}$	131	.2979	.3063
8	Macbeth_{7500K}	133	.2996	.3123
9	Gibson $1/\lambda^4$ (.15 + .85)	135	.3016	.3092
10	Gibson $1/\lambda^4$ (.1 + .9)	143	.3076	.3158
11	Planckian_{7000K}	143	.3063	.3168
12	Macbeth_{6800K}	147	.3081	.3231
13	ICI "C"	149	.3101	.3163
14	Curve portion of $\text{Fluorescent}_{7650K}$	151	.3115	.3197
15	$\text{Fluorescent}_{6500K}$	153	.3129	.3209
16	Carbon Arc	157	.3152	.3321
17	Abbot Daylight	165	.3204	.3301
18	ICI "B"	208	.3485	.3518

Table 2. Spectral energy distribution data reduced to 100 at wavelength 560 mμ for standards and illuminants listed in table 1, with certain supplementary data.

μrd	208	165	157	153	149	147	133	131	110		77
No. on Table 1	18	17	16	15	13	12	8	7[a]	3		2
Description	ICI "B"	**Abbot Daylight**	Carbon Arc	Fluorescent 6500K	ICI "C"	Macbeth 6800K	Macbeth 7500K	Fluorescent 7650K	CO_2 (25mm)	CO_2 (20mm)	Fluorescent 13000K
Wavelength mμ											
360		**60.0**									
70		**63.8**									
80	21.79	**62.0**	101.7		31.34						
90	30.45	**63.9**	125.9		45.02						
400	40.18	**73.4**	127.6	35.1	60.12	72.6	83.3	51.2	92.90	90.7	90.5
10	50.68	**91.5**	125.9	50.6	76.55	86.7	100.0	70.4	113.51	117.2	117.9
20	61.48	**97.0**	120.7	67.5	93.17	96.6	109.6	90.4	116.30	115.5	144.1
30	71.11	**96.9**	106.9	83.1	106.75	103.9	116.4	107.7	110.45	110.6	163.5
40	78.60	**102.9**	103.4	100.0	115.39	105.4	118.1	122.9	124.93	123.2	178.4
450	83.08	**109.6**	101.7	115.6	117.76	108.2	119.5	135.6	141.09	135.9	187.4
60	85.90	**112.0**	100.0	124.7	116.91	107.9	117.0	144.4	111.70	109.3	190.2
70	89.50	**113.5**	100.0	128.6	117.57	106.4	113.9	147.2	111.14	111.3	188.0
80	92.61	**113.6**	101.7	127.3	117.67	103.7	109.7	143.9	139.00	140.8	179.1
90	93.88	**112.1**	103.4	123.4	114.63	102.3	106.5	139.2	117.69	126.1	169.8
500	91.64	**110.7**	105.2	119.5	106.46	100.8	104.6	132.9	107.52	111.5	157.8
10	88.23	**108.5**	106.9	116.9	97.15	98.5	101.6	127.0	121.17	126.8	146.0
20	87.07	**105.9**	106.9	113.0	92.03	94.7	96.9	121.5	120.9	120.6	137.0
30	89.69	**103.4**	106.9	110.4	93.07	90.0	90.7	115.7	106.0	108.7	126.8
40	94.17	**101.7**	105.2	106.5	96.96	88.5	88.0	109.2	98.6	105.6	115.7
550	98.25	**100.9**	103.4	101.3	99.91	93.7	91.8	103.5	90.5	94.1	106.7
60	100.00	**100.0**	100.0	100.0	100.00	100.0	100.0	100.0	100.0	100.0	100.0
70	99.81	**99.1**	98.3	103.9	97.15	103.8	104.8	102.4	94.0	102.5	99.0
80	98.25	**98.6**	94.8	110.4	92.88	96.3	99.5	107.2	71.4	78.9	100.1
90	96.50	**98.3**	91.4	116.9	88.51	85.1	85.4	113.6	67.8	71.5	103.8
600	95.33	**97.4**	87.9	122.1	85.19	79.7	76.8	116.9	95.7	96.9	105.2
10	95.82	**95.2**	86.2	119.5	83.95	78.1	76.2	114.9	47.1	93.0	101.9
20	96.99	**93.1**	84.5	113.0	83.67	75.0	73.0	109.1	54.6	58.0	96.3
30	98.25	**91.0**	82.8	101.3	83.57	69.6	68.2	99.9	52.6	60.3	87.4
40	99.42	**89.3**	81.0	89.6	83.38	62.4	59.7	87.6	75.6	80.6	76.5
650	101.07	**87.5**	81.0	76.6	83.76	61.0	56.7	73.7	105.6	100.3	64.1
60	102.14	**86.0**	81.0	64.9	83.48	63.2	58.6	61.1	87.5	90.4	53.2
70	102.05	**84.6**	82.8	51.9	81.96	70.4	67.6	50.4	48.5	42.5	44.0
80	101.07	**83.3**	82.8	42.9	79.77	79.9	76.8	40.5	49.9	57.0	35.4
90	98.84	**81.4**	84.5	33.8	76.17	85.5	85.1	32.1	48.5	54.2	28.3
700	96.40	**79.1**	84.5	26.0	72.46	84.6	87.4	24.3	64.1	71.5	21.8
10	93.58	**76.8**	86.2		68.76				40.0	36.3	
20	90.37	**74.4**	86.2		64.86				57.4	53.2	
30	86.97	**72.2**			61.16						
40	84.54	**70.2**			58.41						
750	82.88	**68.2**			56.22						
60	82.40				55.18						
70	83.08				55.27						
80	84.63				56.13						
Mercury Lines											
405				83.8				88.1			96.3
436				200.4				208.9			238.9
546				116.6				121.2			133.1
578				28.8				27.1			28.7

a/ Also 1 and 14.

Table 2. Cont'd.

µrd	333	167	154	143	125	111	100	83	143	135	125	110	Beyond 0
No. on Table 1				11	6				10	9	5	4	
Description	Planckian data from Frehafer-Snow tables								Gibson Data $1/\lambda^4$ + Abbot Daylight				
Wavelength mµ	3000K	6000K	65000K	7000K	8000K	9000K	10,000K	12,000K	(.1+.9)	(.15+.85)	(.2+.8)	(.3+.7)	(1.0+.0)
360													
70													
80									85.04	96.56	108.08	131.13	292.42
90									84.67	95.06	105.45	126.22	271.64
400	17.7	96.37	109.4	121.9	145.0	165.3	182.9	212.4	94.26	104.69	115.11	135.97	281.97
10	20.9	98.58	110.6	122.2	143.1	161.2	177.0	202.7	114.19	125.54	136.89	159.58	318.45
20	24.4	100.5	111.5	122.1	140.9	157.2	170.9	193.6	117.96	128.44	138.91	159.87	306.57
30	28.3	102.0	112.2	121.8	138.5	152.9	165.1	184.6	115.08	124.18	133.27	151.45	278.74
40	32.5	103.3	112.5	121.2	136.0	148.6	159.2	176.0	119.61	127.96	136.32	153.03	270.00
450	37.0	104.1	112.4	120.1	133.4	144.3	153.4	167.9	124.93	132.59	140.25	155.58	262.85
60	41.8	104.8	112.2	119.0	130.5	140.0	147.7	160.0	125.40	132.10	138.80	152.20	246.00
70	46.8	105.1	111.7	117.6	127.5	135.7	142.3	152.7	125.02	130.79	136.55	148.07	228.75
80	52.1	105.5	111.0	116.1	124.5	131.4	136.8	145.6	123.29	128.13	132.97	142.66	210.46
90	57.5	105.3	110.0	114.3	121.5	127.2	131.7	138.7	120.01	123.97	127.93	135.84	191.24
500	63.2	105.0	109.0	112.6	118.3	123.0	126.7	132.3	117.05	120.22	123.40	129.75	174.19
10	69.1	104.5	107.7	110.6	115.3	119.0	121.8	126.2	113.42	115.88	118.34	123.27	157.73
20	75.1	103.9	106.3	108.7	112.1	115.0	117.0	120.4	109.55	111.38	113.21	116.86	142.45
30	81.2	103.1	104.8	106.5	109.0	111.1	112.5	114.9	105.95	107.22	108.50	111.04	128.88
40	87.4	102.2	103.4	104.5	106.0	107.2	108.1	109.6	103.29	104.09	104.89	106.48	117.63
550	93.7	101.1	101.7	102.3	103.0	103.6	104.0	104.7	101.65	102.03	102.41	103.16	108.44
60	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.00	100.00	100.00	100.00	100.00
70	106.3	98.77	98.20	97.75	97.05	96.53	95.98	95.46	98.42	98.08	97.74	97.07	92.32
80	112.7	97.51	96.41	95.60	94.14	93.14	92.31	91.19	97.31	96.66	96.02	94.72	85.68
90	119.0	96.03	94.51	93.28	91.36	89.92	88.75	87.16	96.45	95.52	94.60	92.74	79.78
600	125.3	94.62	92.58	91.05	88.50	86.76	85.21	83.34	95.05	93.88	92.70	90.35	73.91
10	131.5	93.09	90.75	88.84	85.87	83.66	82.02	79.73	92.44	91.06	89.68	86.93	67.62
20	137.5	91.63	88.80	86.73	83.24	80.71	78.91	76.20	89.99	88.43	86.87	83.76	61.97
30	143.4	90.02	86.94	84.50	80.68	77.90	75.78	72.97	87.58	85.87	84.16	80.74	56.81
40	149.3	88.40	84.96	82.37	78.18	75.21	72.93	69.78	85.60	83.76	81.91	78.21	52.35
650	155.0	86.71	83.05	80.21	75.73	72.54	70.10	66.83	83.57	81.61	79.64	75.71	48.20
60	160.5	85.09	81.20	78.15	73.36	69.99	67.51	64.02	81.86	79.79	77.71	73.57	44.57
70	166.0	83.43	79.33	76.05	71.12	67.55	64.90	61.33	80.27	78.10	75.94	71.61	41.29
80	171.2	81.83	77.44	74.04	68.83	65.20	62.49	58.77	78.80	76.55	74.30	69.81	38.32
90	176.3	80.17	75.59	72.11	66.73	62.93	60.12	56.38	76.79	74.49	72.18	67.58	35.32
700	181.2	78.47	73.80	70.16	64.68	60.75	57.87	54.09	74.43	72.09	69.76	65.09	32.40
10	185.8	76.82	72.07	68.30	62.67	58.65	55.76	51.89	72.09	69.74	67.38	62.68	29.72
20	190.1	75.20	70.29	66.43	60.70	56.62	53.70	49.77	69.68	67.32	64.97	60.25	27.23
30									67.48	65.12	62.76	58.04	25.00
40									65.48	63.12	60.77	56.05	23.03
750													
60													
70													
80													

Table 3. Computational table for ICI illuminants "B" and "C"[a].

Illuminant "B"			Wave-length in mμ	Illuminant "C"		
$\bar{x}E$	$\bar{y}E$	$\bar{z}E$		$\bar{x}E$	$\bar{y}E$	$\bar{z}E$
3		14	380	4		20
13		60	90	19		89
56	2	268	400	85	2	404
217	6	1033	10	329	9	1570
812	24	3899	20	1238	37	5949
1983	81	9678	30	2997	122	14628
2689	178	13489	40	3975	262	19938
2744	310	14462	450	3915	443	20638
2454	506	14085	60	3362	694	19299
1718	800	11319	70	2272	1058	14972
870	1265	7396	80	1112	1618	9461
295	1918	4290	90	363	2358	5274
44	2908	2449	500	52	3401	2864
81	4360	1371	10	89	4833	1520
541	6072	669	20	576	6462	712
1458	7594	372	30	1523	7934	388
2689	8834	188	40	2785	9149	195
4183	9603	84	550	4282	9832	86
5840	9774	38	60	5880	9841	39
7472	9334	21	70	7322	9147	20
8843	8396	16	80	8417	7992	16
9728	7176	10	90	8984	6627	10
9948	5909	7	600	8949	5316	7
9436	4734	3	10	8325	4176	2
8140	3630	2	20	7070	3153	2
6200	2558		30	5309	2190	
4374	1709		40	3693	1443	
2815	1062		650	2349	886	
1655	612		60	1361	504	
876	321		70	708	259	
465	169		80	369	134	
220	80		90	171	62	
108	39		700	82	29	
53	19		10	39	14	
26	9		20	19	6	
12	4		30	8	3	
6	2		40	4	2	
2	1		750	2	1	
2	1		60	1	1	
1			70	1		
99072	100000	85223	Sums [a]	98041	100000	118103
0.34848	0.35175	0.29977	x_w, y_w, z_w	0.31012	0.31631	0.37357
98954	99964	85149	Sums [a] 400-700	97944	99973	117994
0.34835	0.35190	0.29975	x_w, y_w, z_w	0.31004	0.31646	0.37350

a/ See text

Table 4. Computational table for Carbon Arc and Fluorescent$_{6500K}$.

Carbon Arc $\bar{x}E$	Carbon Arc $\bar{y}E$	Carbon Arc $\bar{z}E$	Wave-length in mμ	Fluorescent$_{6500K}$ $\bar{x}E$	Fluorescent$_{6500K}$ $\bar{y}E$	Fluorescent$_{6500K}$ $\bar{z}E$
136		631	380			
505	12	2412	90			
1740	49	8263	400	383	11	1819
5222	145	24895	10	1680	47	8009
15469	460	74309	20	6923	206	33257
28943	1182	141256	30	18004	736	87872
34362	2269	172364	40	26581	1755	133331
32616	3686	171917	450	29660	3353	156337
27733	5722	159190	60	27674	5710	158851
18635	8679	122797	70	19177	8931	126367
9274	13485	78872	80	9288	13504	78983
3157	20521	45895	90	3014	19588	43810
492	32397	27282	500	447	29456	24806
949	51279	16127	10	830	44874	14114
6454	72382	7972	20	5459	61228	6744
16872	87877	4301	30	13944	72626	3556
29127	95688	2036	40	23603	77539	1650
42758	98164	858	550	33505	76922	672
56697	94892	372	60	45370	75934	298
71428	89226	197	70	60428	75486	166
82866	78679	155	80	77201	73300	143
89439	65970	95	90	91559	67534	98
89074	52915	67	600	98978	58797	75
82428	41354	25	10	91435	45872	27
68840	30697	16	20	73681	32856	18
50702	20915		30	49662	20486	
34614	13524		40	30627	11966	
21908	8269		650	16573	6255	
12743	4714		60	8167	3021	
6898	2526		70	3462	1268	
3693	1342		80	1532	556	
1828	661		90	585	211	
919	331		700	226	82	
477	173		10			
238	82		20			
			Mercury Lines [a]			
			405	1484	38	7048
			436	50836	2753	251841
			546	33280	87560	1094
			578	19511	19539	35
949236	1000267	1062304	Sums	974769	1000000	1141021
0.31517	0.33212	0.35271	x_w, y_w, z_w	0.31285	0.32094	0.36621
947880	1000000	1059261	Sums$_{400-700}$			
0.31521	0.33254	0.35225	x_w, y_w, z_w			
			Sums$_{(excl.\ Hg)}$	869658	890110	881003
			x_w, y_w, z_w	0.32932	0.33706	0.33362
			Sums$_{(Hg\ only)}$	105111	109890	260018
			x_w, y_w, z_w	0.22128	0.23134	0.54738

a/ See text

Table 5. Computational table for Carbon Dioxide, CO_2 (25mm), CO_2, (20mm).

CO_2 (25mm)			Wave-length in mμ	CO_2 (20mm)		
$\bar{x}E$	$\bar{y}E$	$\bar{z}E$		$\bar{x}E$	$\bar{y}E$	$\bar{z}E$
			380			
			90			
135	4	643	400	124	4	589
503	14	2397	10	488	13	2326
1592	48	7646	20	1485	44	7135
3195	130	15592	30	3004	122	14663
4430	292	22222	40	4106	271	20594
4831	546	25464	450	4372	494	23043
3308	682	18988	60	3041	628	17456
2211	1030	14568	70	2081	969	13712
1353	1968	11509	80	1288	1872	10953
384	2493	5576	90	387	2510	5613
54	3536	2978	500	53	3445	2902
115	6208	1952	10	113	6103	1919
779	8742	962	20	730	8193	902
1786	9305	455	30	1721	8965	439
2916	9579	204	40	2935	9639	205
3994	9171	80	550	3902	8959	78
6054	10132	40	60	5688	9519	37
7296	9113	20	70	7475	9337	21
6662	6326	12	80	6918	6568	12
7086	5226	7	90	7021	5179	8
10352	6150	8	600	9848	5850	8
4809	2413	1	10	8921	4476	3
4751	2118	1	20	4742	2115	1
3441	1420		30	3707	1529	
3448	1347		40	3454	1349	
3049	1151		650	2721	1027	
1470	544		60	1427	527	
432	158		70	355	130	
238	87		80	255	93	
112	41		90	118	42	
74	26		700	78	28	
23	8		10	20	8	
17	6		20	14	5	
90900	100015	131325	Sums	92592	100014	122619
0.28209	0.31037	0.40754	x_w, y_w, z_w	0.29373	0.31728	0.38899
90860	100000	131325	$Sums_{400-700}$	92558	100000	122619
0.28201	0.31038	0.40761	x_w, y_w, z_w	0.29367	0.31728	0.38905

Table 6. Computational table for $\text{Fluorescent}_{7650K}$ and $\text{Fluorescent}_{13000K}$.

$\text{Fluorescent}_{7650K}$			Wave-length in mμ	$\text{Fluorescent}_{13000K}$		
$\bar{x}E$	$\bar{y}E$	$\bar{z}E$		$\bar{x}E$	$\bar{y}E$	$\bar{z}E$
			380			
			90			
54914	1536	260744	400	94209	2635	447329
229687	6336	1095106	10	373347	10299	1780048
911260	27121	4377304	20	1409848	41960	6772307
2293274	93702	11192533	30	3379032	138065	16491674
3210555	212009	16104396	40	4523321	298698	22689333
3419261	386472	18022819	450	4586447	518397	24175025
3149462	649820	18077999	60	4026373	830751	23111493
2157283	1004671	14215547	70	2674185	1245399	17621705
1031795	1500204	8774576	80	1246415	1812256	10599741
334090	2171588	4856839	90	395546	2571048	5750247
48842	3219603	2711244	500	56288	3710382	3124532
88585	4791224	1506902	10	98843	5346012	1681390
576839	6470077	712620	20	631297	7080893	779896
1436171	7480238	366202	30	1527659	7956749	389530
2378450	7813502	166262	40	2445902	8035091	170977
3364372	7723928	67536	550	3366375	7728524	67576
4458888	7462733	29251	60	4327738	7243228	28391
5853110	7311588	16129	70	5492326	6860903	15134
7367282	6995018	13668	80	6676992	6339609	12388
8744348	6449841	9372	90	7754982	5720083	8312
9313129	5532465	7014	600	8134505	4832304	6127
8640175	4334738	2585	10	7437226	3731224	2225
6991346	3117630	1637	20	5989584	2670917	1402
4813332	1985574		30	4087202	1686034	
2942795	1149786		40	2494317	974560	
1567095	591461		650	1322879	499288	
755678	279541		60	638618	236238	
330382	120964		70	279945	102497	
142159	51639		80	120603	43809	
54652	19742		90	46765	16893	
20777	7472		700	18091	6507	
			Mercury Lines a/			
153299	3965	728169	405	162639	4206	772533
5208039	282024	25800476	436	5780778	313039	28637806
3399766	8944839	111810	546	3623755	9534156	119177
1804306	1806949	3252	578	1854630	1857346	3343
97245398	100000000	129231992	Sums	97078662	100000000	165259641
0.29786	0.30630	0.39584	x_w, y_w, z_w	0.26792	0.27599	0.45609
86679988	88962223	102588285	$\text{Sums}_{(\text{excl.Hg})}$	85656860	88291253	135726782
0.31154	0.31974	0.36872	x_w, y_w, z_w	0.27660	0.28511	0.43829
10565410	11037777	26643707	$\text{Sums}_{(\text{Hg only})}$	11421802	11708747	29532859
0.21898	0.22878	0.55224	x_w, y_w, z_w	0.21688	0.22233	0.56079

a/ See text

Table 7. Computational table for Macbeth$_{6800K}$ and Macbeth$_{7500K}$.

Macbeth$_{6800K}$			Wave-length	Macbeth$_{7400K}$		
$\bar{x}E$	$\bar{y}E$	$\bar{z}E$	in mμ	$\bar{x}E$	$\bar{y}E$	$\bar{z}E$
			380			
			90			
10664	299	50634	400	12158	340	57730
38751	1069	184758	10	44434	1226	211853
133311	3968	640366	20	150423	4477	722565
302898	12376	1478319	30	337728	13799	1648314
376937	24891	1890742	40	420248	27751	2107997
373425	42208	1968311	450	410377	46384	2163084
322188	66476	1849367	60	347541	71708	1994897
213377	99372	1406057	70	227337	105873	1498053
101766	147966	865439	80	107105	155728	910843
33625	218562	488822	90	34811	226268	506056
5070	334234	281460	500	5237	345213	290706
9409	508874	160047	10	9652	522039	164188
61559	690477	76050	20	62640	702600	77385
153049	797152	39025	30	153347	798703	39101
263759	866481	18437	40	260990	857386	18244
417010	957370	8371	550	406192	932535	8154
610539	1021844	4005	60	607265	1016365	3984
811872	1014174	2237	70	816166	1019538	2249
906577	860769	1682	80	923100	884419	1728
897335	661875	962	90	895131	660250	959
869379	516455	655	600	834048	495466	628
804478	403603	241	10	780455	391551	233
658088	293459	154	20	637255	284169	149
458861	189287		30	447940	184782	
287161	112198		40	273203	106744	
177777	67097		650	164066	61922	
107058	39596		60	98802	36549	
63238	23154		70	60328	22088	
38424	13958		80	36711	13335	
19928	7198		90	19736	7129	
9899	3560		700	10186	3663	
9537412	10000000	11416141	Sums	9594612	10000000	12429100
0.30812	0.32306	0.36882	x_W, y_W, z_W	0.29961	0.31227	0.38812

Table 8. Computational table for Abbot Daylight and Gibson $1/\lambda^4$ (.1 + .9)

Abbot Daylight			Wave-length in mμ	Gibson $1/\lambda^4$ (.1 + .9)		
$\bar{x}E$	$\bar{y}E$	$\bar{z}E$		$\bar{x}E$	$\bar{y}E$	$\bar{z}E$
8		37	380	1100		5106
25	1	119	90	3284	79	15719
98	3	463	400	12449	348	59113
370	10	1766	10	45878	1265	218736
1213	36	5826	20	146425	4358	703366
2560	104	12492	30	301750	12329	1472720
3335	221	16728	40	384773	25408	1930047
3429	387	18071	450	387925	43846	2044738
3030	625	17395	60	336802	69491	1933253
2064	961	13598	70	225625	105076	1486768
1010	1469	8594	80	108860	158280	925766
334	2170	4852	90	35469	230549	515632
50	3327	2802	500	5297	349186	294051
94	5078	1597	10	9742	526915	165721
623	6996	770	20	64047	718379	79123
1592	8293	406	30	161950	843511	41295
2748	9028	192	40	277037	910101	19366
4069	9342	82	550	406892	934144	8168
5532	9258	36	60	549079	918979	3602
7027	8778	20	70	692753	865372	1909
8407	7981	16	80	823527	781915	1528
9387	6924	10	90	914238	674342	980
9626	5719	7	600	932483	553942	702
8881	4456	3	10	855993	429448	256
7401	3300	2	20	710131	316666	166
5439	2244		30	519629	214355	
3722	1454		40	354109	138355	
2308	871		650	218820	82588	
1319	489		60	124674	46120	
688	252		70	64796	23724	
363	132		80	34060	12373	
172	62		90	16099	5816	
84	30		700	7837	2819	
42	15		10	3862	1398	
20	6		20	1867	644	
9	4		30	873	311	
5	2		40	423	181	
2	1		750			
97086	100029	105884	Sums	9740558	10002612	11927831
0.32042	0.33013	0.34945	x_w, y_w, z_w	0.30755	0.31583	0.37662
96975	100000	105728	$\text{Sums}_{400-700}$	9729149	10000000	11907006
0.32037	0.33035	0.34928	x_w, y_w, z_w	0.30753	0.31609	0.37638

Table 9. Computational table for Gibson $1/\lambda^4$ (.15 + .85) and (.2 + .8)

Gibson $1/\lambda^4$ (.15 + .85)			Wave-length in mμ	Gibson $1/\lambda^4$ (.2 + .8)		
$\bar{x}E$	$\bar{y}E$	$\bar{z}E$		$\bar{x}E$	$\bar{y}E$	$\bar{z}E$
1244		5775	380	1387		6441
3674	87	17578	90	4061	96	19432
13776	386	65412	400	15092	422	71658
50252	1386	239592	10	54593	1506	260290
158847	4728	763035	20	171163	5094	822195
324413	13255	1583325	30	346877	14173	1692964
410118	27082	2057181	40	435302	28746	2183509
410194	46363	2162119	450	432292	48861	2278603
353491	72935	2029045	60	370050	76352	2124102
235169	109521	1549659	70	244621	113922	1611945
112717	163888	958566	80	116543	169451	991110
36504	237280	530685	90	37532	243957	545619
5421	357322	300902	500	5544	365422	307724
9917	536361	168692	10	10090	545729	171639
64878	727690	80148	20	65700	736921	81165
163288	850479	41636	30	164629	857461	41978
278154	913773	19444	40	279260	917403	19522
406909	934181	8169	550	406920	934207	8169
547057	915596	3589	60	545041	912222	3576
687818	859208	1896	70	682908	853074	1882
815014	773832	1512	80	806634	765876	1496
902089	665381	967	90	890109	656545	954
917614	545109	691	600	902741	536274	681
840110	421479	251	10	824330	413562	247
695251	310031	163	20	680469	303440	160
507607	209396		30	495666	204470	
345222	134882		40	336353	131417	
212900	80354		650	206996	78126	
121074	44788		60	117483	43459	
62812	22998		70	60850	22279	
32966	11975		80	31879	11580	
15560	5621		90	15022	5427	
7562	2720		700	7291	2622	
3722	1348		10	3583	1297	
1796	619		20	1727	596	
839	300		30	806	288	
407	174		40	390	167	
9756386	10002529	12590032	Sums	9771934	10002444	13247061
0.30160	0.30921	0.38919	x_w, y_w, z_w	0.29593	0.30291	0.40116
9744704	10000000	12566679	$\text{Sums}_{400-700}$	9759980	10000000	13221188
0.30159	0.30949	0.38892	x_w, y_w, z_w	0.29593	0.30320	0.40087

Table 10. Computational table for Gibson $1/\lambda^4$ (.3 + .7) and (1.0+0)

Gibson $1/\lambda^4$ (.3 + .7)			Wave-length in mμ	Gibson $1/\lambda^4$ (1.0 + 0)		
$\bar{x}E$	$\bar{y}E$	$\bar{z}E$		$\bar{x}E$	$\bar{y}E$	$\bar{z}E$
1671		7757	380	3545		16459
4825	115	23090	90	9880	236	47282
17697	495	84028	400	34917	977	165795
63179	1743	301228	10	119958	3309	571938
195557	5820	939373	20	356802	10619	1713926
391330	15989	1909918	30	685273	28000	3344537
485107	32034	2433335	40	814359	53776	4084890
476057	53807	2509283	450	765252	86495	4033621
402826	83114	2312228	60	619482	127816	3555841
263330	122636	1735224	70	387066	180260	2550592
124127	180478	1055603	80	174232	253328	1481696
39563	257157	575142	90	52994	344462	770401
5787	381432	321206	500	7391	487220	410290
10434	564330	177489	10	12703	687039	216083
67325	755148	83173	20	78085	875830	96465
167257	871153	42648	30	184706	962037	47097
281431	924536	19673	40	295811	971774	20678
406919	934206	8168	550	406984	934354	8169
541078	905588	3550	60	514814	861632	3377
673293	841065	1855	70	609266	761082	1679
789927	750013	1465	80	679855	645502	1262
866262	638956	928	90	709034	522985	760
873458	518877	658	600	679843	403860	512
793241	397965	238	10	587086	294539	176
651336	290449	153	20	458503	204459	107
472065	194734		30	316030	130367	
318824	124569		40	203047	79333	
195350	73730		650	118331	44661	
110415	40845		60	63645	23544	
56963	20856		70	31250	11442	
29735	10802		80	15530	5641	
13962	5044		90	6943	2508	
6753	2429		700	3199	1150	
3308	1198		10	1493	540	
1590	548		20	684	236	
740	264		30	303	108	
357	153		40	139	60	
9803079	10002278	14547413	Sums	10008435	10001180	23143633
0.28537	0.29116	0.42347	x_W, y_W, z_W	0.23193	0.23176	0.53631
9790588	10000000	14516566	$\text{Sums}_{400-700}$	9992391	10000000	23079892
0.28538	0.29148	0.42314	x_W, y_W, z_W	0.23199	0.23217	0.53584

Table 11. Computational table for Planckian 7000K and 8000K

Planckian$_{7000K}$			Wave-length in mμ	Planckian$_{8000K}$		
$\bar{x}E$	$\bar{y}E$	$\bar{z}E$		$\bar{x}E$	$\bar{y}E$	$\bar{z}E$
			380			
			90			
1636	46	7767	400	194	5	919
4986	137	23776	10	581	16	2769
15396	459	73954	20	1768	53	8493
32422	1325	158237	30	3669	150	17908
39593	2615	198602	40	4421	292	22177
37865	4280	199583	450	4185	473	22057
32472	6700	186388	60	3543	731	20335
21545	10034	141975	70	2326	1083	15324
10408	15132	88505	80	1111	1616	9447
3433	22316	49911	90	363	2358	5274
517	34117	28730	500	54	3566	3003
965	52205	16420	10	100	5412	1702
6453	72384	7972	20	662	7427	818
16539	86145	4217	30	1683	8767	429
28463	93502	1990	40	2872	9433	200
41606	95518	835	550	4168	9568	84
55770	93341	366	60	5550	9288	37
69893	87309	193	70	6900	8619	19
82190	78037	152	80	8054	7647	15
89812	66245	96	90	8749	6453	9
90723	53894	68	600	8772	5211	7
83553	41918	25	10	8033	4031	3
69513	30998	17	20	6636	2959	2
50927	21008		30	4837	1995	
34610	13522		40	3268	1276	
21331	8051		650	2003	756	
12090	4473		60	1129	418	
6236	2283		70	580	212	
3251	1181		80	301	109	
1536	555		90	142	51	
750	270		700	69	25	
372	135		10	34	12	
181	62		20	16	6	
967037	1000197	1189779	Sums	96773	100018	131002
0.30631	0.31682	0.37687	x_w, y_w, z_w	0.29523	0.30512	0.39965
966484	1000000	1189779	Sums$_{400-700}$	96723	100000	131002
0.30621	0.31683	0.37696	x_w, y_w, z_w	0.29513	0.30514	0.39973

Table 12. Table of equivalents: Color temperature in degrees K and in micro-reciprocal degrees (mireds or µrd) a/

µrd	Color temperature	Color temperature	µrd
10	100,000	4,800	208
50	20,000	4,900	204
100	10,000	5,000	200
125	8,000	5,100	196
130	7,692	5,200	192
131	7,634	5,300	189
132	7,576	5,400	185
133	7,519	5,500	182
134	7,463	5,600	179
135	7,407	5,700	175
136	7,353	5,800	172
137	7,299	5,900	169
138	7,246	6,000	167
139	7,194	6,100	164
140	7,143	6,200	161
141	7,092	6,300	159
142	7,042	6,400	156
143	6,993	6,500	154
144	6,944	6,600	152
145	6,897	6,700	149
146	6,849	6,800	147
147	6,803	6,900	145
148	6,757	7,000	143
149	6,711	7,100	141
150	6,667	7,200	139
151	6,622	7,300	137
152	6,579	7,400	135
153	6,536	7,500	133
154	6,494	7,600	132
155	6,452	7,700	130
156	6,410	7,800	128
157	6,369	7,900	127
158	6,329	8,000	125
159	6,289	8,500	118
160	6,250	9,000	111
161	6,211	9,500	105
162	6,173	10,000	100
163	6,135	11,000	91
164	6,098	12,000	83
165	6,061	13,000	77
175	5,714	14,000	71
200	5,000	15,000	67
205	4,878	20,000	50
210	4,762	25,000	40
215	4,651	50,000	20
		75,000	13

a/ See text

Table 13. Spectral apparent reflectance data for 8 pairs of samples selected for use in studying various illuminants a/

Wave-length mµ	Judd Pairs								Other Pairs							
	Olive		Green		Blue		Brown		Orange-Blue		Yellows		Coffee		Tobacco	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
400	.066	.029	.130	.066	.419	.333	.043	.046	.350	.400	.070	.070	.029	.024	.035	.040
10	.066	.030	.131	.068	.420	.343	.043	.046	.300	.430	.070	.070	.029	.024	.035	.040
20	.065	.032	.130	.073	.414	.351	.043	.046	.250	.470	.075	.075	.030	.025	.037	.040
30	.063	.039	.128	.086	.406	.358	.043	.046	.230	.500	.080	.080	.030	.025	.037	.040
40	.061	.046	.124	.106	.393	.363	.043	.046	.210	.530	.090	.090	.031	.026	.038	.042
450	.058	.051	.125	.132	.380	.368	.043	.046	.200	.550	.100	.100	.032	.026	.039	.044
60	.055	.054	.132	.163	.362	.371	.044	.047	.195	.570	.110	.110	.032	.027	.040	.046
70	.050	.065	.151	.200	.346	.376	.044	.049	.195	.585	.130	.130	.033	.028	.045	.050
80	.046	.101	.180	.242	.328	.386	.044	.053	.195	.590	.155	.155	.034	.029	.047	.052
90	.042	.132	.215	.281	.309	.408	.044	.062	.195	.585	.195	.195	.035	.030	.052	.056
500	.040	.131	.256	.303	.289	.391	.044	.067	.200	.580	.240	.240	.036	.031	.060	.060
10	.043	.117	.279	.301	.270	.348	.044	.061	.205	.560	.350	.300	.038	.033	.070	.067
20	.052	.093	.274	.282	.251	.277	.045	.052	.220	.540	.500	.370	.040	.035	.080	.074
30	.068	.075	.247	.252	.233	.221	.046	.051	.250	.530	.580	.430	.042	.036	.090	.080
40	.085	.065	.211	.213	.217	.183	.047	.052	.290	.510	.620	.480	.044	.038	.098	.086
550	.101	.058	.177	.182	.201	.167	.048	.054	.350	.490	.630	.520	.046	.041	.108	.095
60	.114	.054	.145	.148	.188	.153	.051	.056	.420	.470	.630	.560	.048	.042	.116	.102
70	.123	.053	.110	.116	.174	.141	.057	.058	.500	.460	.620	.580	.051	.045	.130	.110
80	.124	.051	.083	.087	.163	.129	.065	.061	.560	.450	.600	.600	.054	.047	.142	.120
90	.115	.050	.064	.068	.153	.126	.077	.068	.620	.440	.580	.610	.057	.050	.155	.132
600	.100	.050	.052	.056	.142	.132	.090	.078	.650	.425	.565	.610	.060	.054	.170	.143
10	.083	.057	.044	.048	.134	.132	.100	.082	.680	.415	.550	.600	.064	.058	.177	.155
20	.070	.079	.036	.039	.128	.130	.107	.083	.710	.400	.530	.590	.069	.061	.191	.168
30	.058	.116	.029	.032	.122	.131	.107	.084	.730	.390	.515	.580	.074	.066	.211	.185
40	.053	.166	.024	.026	.120	.144	.101	.091	.740	.380	.495	.565	.078	.070	.226	.202
650	.055	.229	.022	.024	.116	.173	.101	.108	.750	.375	.475	.550	.083	.075	.226	.214
60	.078	.295	.026	.030	.105	.217	.105	.140	.750	.375	.450	.530	.089	.080	.200	.208
70	.118	.358	.036	.043	.098	.279	.107	.198	.750	.375	.430	.515	.095	.086	.185	.211
80	.166	.405	.054	.064	.093	.367	.105	.262	.750	.380	.410	.500	.102	.093	.240	.254
90	.220	.435	.079	.096	.091	.462	.103	.342	.750	.390	.390	.480	.108	.098	.330	.296
700	.280	.460	.116	.140	.090	.546	.100	.419	.750	.400	.370	.460	.114	.104	.370	.322

a/ See text

Table 14. Spectral apparent reflectance for 30 cotton samples selected for use in studying various illuminants a/

Wave-length mµ	Sample Number														
	401	402	403	404	405	406	407	408	409	410	411	412	801	802	803
400	.560	.568	.569	.567	.576	.574	.560	.594	.575	.556	.515	.528	.512	.516	.521
10	571	571	581	581	588	584	572	608	584	569	526	541	523	528	.531
20	591	592	600	602	608	606	594	629	607	591	546	562	538	543	550
30	611	613	620	625	629	625	616	648	629	612	566	584	552	560	570
40	630	632	638	644	646	643	636	666	648	633	585	604	567	576	589
450	.644	.649	.655	.660	.661	.658	.652	.681	.665	.650	.602	.623	.580	.589	.604
60	659	662	670	677	678	674	669	697	681	668	620	641	591	601	620
70	674	678	684	692	692	689	684	712	698	682	637	658	603	616	634
80	689	692	699	708	706	702	698	726	712	699	652	674	616	628	647
90	701	706	711	721	718	714	711	737	725	711	667	689	628	638	659
500	.713	.718	.721	.732	.729	.726	.722	.747	.736	.724	.681	.699	.638	.647	.671
10	726	728	730	741	737	736	731	755	746	734	693	709	648	654	681
20	736	737	737	748	743	744	739	760	752	741	703	713	657	659	690
30	746	746	743	752	748	751	745	765	757	749	711	718	664	664	699
40	755	764	749	757	754	756	751	769	762	754	719	720	671	669	706
550	.764	.761	.764	.761	.758	.764	.757	.772	.767	.760	.726	.724	.678	.672	.714
60	771	767	759	766	762	769	763	776	771	765	731	728	683	676	720
70	777	773	764	771	767	774	768	780	776	770	739	732	689	681	727
80	784	779	769	776	771	779	774	784	781	776	745	737	695	686	733
90	790	785	776	781	776	784	779	789	785	780	751	742	701	690	739
600	.796	.790	.779	.785	.781	.789	.784	.792	.790	.785	.758	.748	.707	.695	.745
10	802	796	784	790	786	794	780	798	795	790	765	754	713	701	751
20	809	801	791	797	793	800	796	804	802	797	774	764	720	709	758
30	814	809	799	805	801	806	803	813	810	804	781	774	729	717	766
40	819	815	807	813	809	814	811	821	819	814	791	784	737	726	775
650	.825	.822	.814	.822	.819	.821	.819	.830	.828	.821	.799	.796	.747	.735	.783
60	830	830	822	833	829	829	828	839	837	831	810	809	757	746	793
70	835	838	832	844	839	838	836	849	847	840	821	821	768	755	802
80	840	844	840	851	846	845	844	856	855	848	830	832	777	766	811
90	843	849	844	856	851	850	849	861	859	852	836	838	784	771	817
700	.846	.854	.849	.860	.855	.855	.851	.865	.864	.855	.841	.842	.790	.777	.822

Wave-length mµ	Sample Number														
	803a	804	805	806	807	808	809	810	811	812	330	330a	430	530	630
400	.535	.492	.524	.486	.523	.518	.522	.499	.505	.470	.525	.512	.491	.515	.490
10	547	502	533	495	534	525	530	510	517	480	537	526	506	530	501
20	565	517	549	509	553	539	542	526	531	497	559	546	527	550	518
30	585	533	566	523	572	552	556	542	548	514	578	566	548	570	534
40	603	549	580	537	589	566	569	560	564	531	598	587	568	588	551
450	.620	.562	.594	.548	.605	.576	.580	.575	.578	.544	.614	.604	.586	.604	.567
60	634	576	607	560	620	587	590	590	591	558	631	621	606	621	582
70	647	590	620	571	635	598	600	604	603	573	648	639	624	638	599
80	660	602	633	581	648	608	609	618	616	586	661	655	641	654	614
90	672	614	645	591	661	618	619	630	627	600	678	671	657	672	626
500	.684	.625	.656	.601	.672	.627	.627	.639	.638	.614	.690	.686	.673	.688	.639
10	695	633	665	611	681	634	634	646	646	634	702	699	686	702	650
20	704	640	673	619	687	638	639	652	654	633	710	708	698	715	660
30	711	646	680	625	692	641	643	657	659	641	718	715	709	725	670
40	720	653	687	631	698	646	648	661	665	648	725	721	718	735	680
550	.728	.658	.692	.636	.701	.649	.651	.665	.671	.655	.730	.728	.725	.744	.690
60	734	663	698	641	706	653	655	670	676	662	736	733	733	752	699
70	740	669	704	646	711	657	658	675	680	668	742	739	740	760	708
80	748	674	710	651	716	660	662	679	685	675	748	745	749	768	716
90	753	679	715	657	720	665	666	684	690	681	[illegible]	750	756	775	724
600	.759	.684	.721	.662	.726	.670	.670	.689	.696	.688	.760	.756	.763	.782	.732
10	766	690	728	669	732	675	676	696	700	697	767	763	771	790	740
20	773	697	735	676	741	681	681	704	708	706	773	771	779	798	749
30	780	704	742	684	751	690	689	713	715	716	782	780	789	806	758
40	788	713	752	691	761	697	697	721	723	726	791	790	797	815	768
650	.795	.720	.761	.701	.771	.705	.704	.730	.730	.736	.800	.800	.806	.823	.777
60	805	730	771	710	784	715	713	741	739	749	811	811	817	834	786
70	814	739	781	720	795	725	721	752	749	759	821	821	827	843	795
80	821	748	790	729	805	732	730	761	757	771	830	830	836	851	803
90	827	764	797	735	811	739	735	767	764	778	836	836	841	858	810
700	.833	.760	.802	.741	.815	.743	.740	.772	.768	.783	.841	.841	.846	.863	.815

a/ See text

Table 15. Formulas for converting ICI values for $\bar{x}$, $\bar{y}$, $\bar{z}$ to UCS values for $\bar{r}$, $\bar{g}$, $\bar{b}$ [a/]

$$\bar{r} = 3.1956\,\bar{x} + 2.4478\,\bar{y} - 0.1434\,\bar{z}$$

$$\bar{g} = -2.5455\,\bar{x} + 7.0492\,\bar{y} + 0.9963\,\bar{z}$$

$$\bar{b} = 0.0000\,\bar{x} + 0.0000\,\bar{y} + 1.0000\,\bar{z}$$

and the reverse transformation:

$$\bar{x} = 0.24513\,\bar{r} - 0.08512\,\bar{g} + 0.11996\,\bar{b}$$

$$\bar{y} = 0.08852\,\bar{r} + 0.11112\,\bar{g} - 0.09802\,\bar{b}$$

$$\bar{z} = 0.00000\,\bar{r} + 0.00000\,\bar{g} + 1.00000\,\bar{b}$$

a/ See text

Table 16. Differences in reflectance (ICI - Y value) and chromaticity (in UCS units for r, g, and b) for pairs of colors selected by Judd, as calculated for 15 illuminants a/

Illuminant		Differences in Y values, and in UCS units															
Description	Approx. color temperature in µrd	Olive Pair				Green Pair				Blue Pair				Brown Pair			
		Y	r	g	b	Y	r	g	b	Y	r	g	b	Y	r	g	b
		$x10^{-3}$	$x10^{-4}$	$x10^{-4}$	$x10^{-4}$	$x10^{-3}$	$x10^{-4}$	$x10^{-4}$	$x10^{-4}$	$x10^{-3}$	$x10^{-4}$	$x10^{-4}$	$x10^{-4}$	$x10^{-3}$	$x10^{-4}$	$x10^{-4}$	$x10^{-4}$
ICI "B"	208	13	- 30	- 105	+ 135	9	- 31	+ 18	+ 13	5	- 42	+ 10	+ 32	1	- 243	+ 195	+ 48
Abbot Daylight	165	12	-177	- 41	+ 136	10	- 34	+ 29	+05	04	- 69	+ 47	+ 22	02	- 268	+ 215	+ 53
Carbon Arc	157	13	- 164	- 48	+ 116	09	- 28	+ 40	-12	04	- 59	+ 45	+ 14	03	- 247	+ 199	+ 48
Fluorescent Daylight$_{6500K}$	153	17	- 242	- 101	+ 141	09	- 24	+ 44	-20	07	- 84	+ 54	+ 30	01	- 319	+ 257	+ 62
ICI "C"	149	13	- 275	- 132	+ 143	10	- 36	+ 33	+03	04	- 65	+ 42	+ 23	02	- 253	+ 200	+ 53
Macbeth$_{6800K}$	147	15	- 246	- 97	+ 149	09	- 33	+ 35	-02	05	- 77	+ 54	+ 23	02	- 249	+ 198	+ 51
Planckian$_{7000K}$	143	12	- 202	- 78	+ 124	10	- 30	+ 40	-10	04	- 68	+ 54	+ 14	02	- 260	+ 208	+ 52
Gibson$_{7000K}$	143	11	- 209	- 78	+ 131	10	- 34	+ 36	-02	03	- 72	+ 57	+ 15	02	- 269	+ 215	+ 54
Gibson$_{7500K}$	135	11	- 225	- 96	+ 129	10	- 34	+ 40	-06	03	- 73	+ 60	+ 13	02	- 270	+ 215	+ 55
Macbeth$_{7500K}$	133	14	- 269	- 119	+ 150	10	- 33	+ 40	-07	04	- 79	+ 59	+ 20	02	- 247	+ 196	+ 51
Fluorescent + Blue$_{7650K}$	131	15	- 275	- 138	+ 137	09	- 26	+ 50	-24	06	- 86	+ 64	+ 22	01	- 286	+ 235	+ 51
Gibson$_{8000K}$	125	10	- 240	- 114	+ 126	10	- 34	+ 42	-08	03	- 73	+ 65	+ 08	02	- 269	+ 215	+ 54
Gibson$_{9000K}$	110	10	- 268	- 148	+ 120	11	- 34	+ 49	-15	01	- 76	+ 73	+ 03	02	- 268	+ 213	+ 55
CO_2 (25mm)	110	08	- 230	- 114	+ 116	10	- 36	+ 41	-05	01	-127	+121	+ 06	03	- 229	+ 187	+ 42
Fluorescent + Blue$_{13000K}$	77	14	- 399	- 255	+ 144	10	- 25	+ 58	-33	05	- 33	+ 22	+ 11	02	- 314	+ 231	+ 83

a/ See text

Table 17. Differences in reflectance (ICI - Y value) and chromaticity (in UCS units for r, g, and b) for 2 pairs of colors selected for calculation under 10 illuminants a/

Illuminant		Differences in Y values, and in UCS units							
Description	Approx. color temperature in µrd	Yellow Pair				Orange and Blue Pair			
		Y	r	g	b	Y	r	g	b
		$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
Carbon Arc	157	4756	- 2369	+ 2511	- 142	6401	+12514	- 7592	- 4922
Fluorescent$_{6500K}$	153	4783	- 2294	+ 2450	- 156	5890	+12238	- 6925	- 5313
ICI "C"	149	4461	- 2310	+ 2464	- 154	6011	+12842	- 7343	- 5499
Macbeth$_{6800K}$	147	4600	- 2195	+ 2347	- 152	6311	+12225	- 6934	- 5291
Planckian$_{7000K}$	143	4655	- 2338	+ 2498	- 160	6619	+12738	- 7379	- 5359
Macbeth$_{7500K}$	133	4620	- 2140	+ 2308	- 168	6674	+12173	- 6631	- 5542
Fluorescent$_{7650K}$	131	4952	- 2240	+ 2428	- 188	6948	+12277	- 6643	- 5634
Planckian$_{8000K}$	125	4769	- 2279	+ 2465	- 186	7325	+11663	- 7062	- 5601
CO_2 (25mm)	110	5242	- 2195	+ 1411	- 216	9188	+12309	- 6873	- 5436
Fluorescent$_{13000K}$	77	5358	- 2056	+ 2333	- 277	9153	+11912	- 5735	- 6177

a/ See text

Table 18. Differences in reflectance (ICI - Y value) and chromaticity (in UCS units for r, g, and b) for one pair each of tobacco and coffee colors calculated for four illuminants a/

Illuminant		Differences in Y values, and in UCS units							
Description	Approx. color temperature in µrd	Tobacco Pair				Coffee Pair			
		Y	r	g	b	Y	r	g	b
		$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
ICI "C"	149	1390	+ 820	+ 20	+ 840	603	- 427	+ 162	+ 265
Gibson $1/\lambda^4$ (.15 + .85)	135	1367	+ 891	+ 3	+ 888	600	- 428	+ 150	+ 278
Macbeth$_{7500K}$	133	1384	+ 873	+ 18	+ 891	600	- 401	+ 126	+ 275
Fluorescent$_{7650K}$	131	1389	+ 921	+ 18	+ 903	602	- 414	+ 136	+ 278

a/ See text

Table 19. Differences in reflectance (ICI - Y value) and chromaticity (in UCS units of r, g, and b) for 5 pairs of cotton colors [a/]

Illuminant No.	Illuminant Description	Approx. color temperature in µrd	ICI values Equal Energy x	ICI values Equal Energy y	Pair 1 Y $x10^{-5}$	Pair 1 r $x10^{-5}$	Pair 1 g $x10^{-5}$	Pair 1 b $x10^{-5}$	Pair 2 Y $x10^{-5}$	Pair 2 r $x10^{-5}$	Pair 2 g $x10^{-5}$	Pair 2 b $x10^{-5}$
1	ICI "B"	208	.3485	.3518	255	+ 85	- 39	- 46	71	+ 295	-112	- 183
2	Abbot Daylight	165	.3204	.3301	231	+ 88	- 36	- 52	05	+ 308	- 99	- 209
3	Carbon Arc	157	.3152	.3321	226	+ 84	- 34	- 50	15	+ 298	- 91	- 207
4	$Fluorescent_{6500K}$	153	.3129	.3209	222	+ 89	- 35	- 54	38	+ 299	- 75	- 224
5	Curve portion of $Fluorescent_{7650K}$	151	.3115	.3197	226	+ 94	- 39	- 55	32	+ 326	- 105	- 221
6	ICI "C"	149	.3101	.3163	228	+ 102	- 45	- 67	14	+ 311	- 86	- 225
7	$Macbeth_{6800K}$	147	.3081	.3231	229	+ 85	- 31	- 54	10	+ 301	- 82	- 219
8	$Planckian_{7000K}$	143	.3063	.3168	222	+ 89	- 35	- 54	34	+ 307	- 84	- 223
9	Gibson $1/\lambda^4$ (.1+.9)	143	.3076	.3158	222	+ 89	- 35	- 54	35	+ 314	- 91	- 223
10	Gibson $1/\lambda^4$ (.15+.85)	135	.3016	.3092	217	+ 90	- 33	- 57	50	+ 315	- 84	- 231
11	$Macbeth_{7500K}$	133	.2996	.3123	224	+ 86	- 29	- 57	26	+ 303	- 72	- 231
12	$Fluorescent_{7650K}$	131	.2979	.3063	216	+ 89	- 31	- 58	09	+ 304	- 65	- 239
13	$Planckian_{8000K}$	125	.2952	.3051	213	+ 88	- 31	- 57	63	+ 310	- 75	- 235
14	Gibson $1/\lambda^4$ (.2+.8)	125	.2959	.3029	212	+ 90	- 32	- 58	65	+ 317	- 81	- 236
15	Gibson $1/\lambda^4$ (.3+.7)	110	.2854	.2912	203	+ 89	- 29	- 60	94	+ 318	- 69	- 249
16	CO_2 (25mm)	110	.2820	.3104	187	+ 84	- 29	- 55	137	+ 288	- 69	- 219
17	$Fluorescent_{13000K}$	77	.2679	.2760	184	+ 87	- 24	- 63	15	+ 282	- 14	- 268
18	Mercury lines of $Fluorescent_{7650K}$	Beyond 0	.2190	.2288	143	+ 28	+ 39	-67	177	+ 138	+217	- 355

Illuminant No.	Illuminant Description	Approx. color temperature in µrd	Pair 3 Y $x10^{-5}$	Pair 3 r $x10^{-5}$	Pair 3 g $x10^{-5}$	Pair 3 b $x10^{-5}$	Pair 4 Y $x10^{-5}$	Pair 4 r $x10^{-5}$	Pair 4 g $x10^{-5}$	Pair 4 b $x10^{-5}$	Pair 5 Y $x10^{-5}$	Pair 5 r $x10^{-5}$	Pair 5 g $x10^{-5}$	Pair 5 b $x10^{-5}$
1	ICI "B"	208	118	+ 33	- 06	- 27	1798	+ 04	+ 21	- 25	63	- 56	+ 127	- 71
2	Abbot Daylight	165	119	+ 25	- 05	- 20	1789	+ 15	+ 15	- 30	3376	- 53	+ 125	- 72
3	Carbon Arc	157	122	+ 25	- 04	- 21	1788	+ 17	+ 18	- 35	3390	- 50	+ 129	- 79
4	$Fluorescent_{6500K}$	153	126	+ 25	- 04	- 21	1796	+ 17	+ 20	- 37	3383	- 42	+ 123	- 81
5	Curve portion of $Fluorescent_{7650K}$	151	120	+ 24	- 03	- 21	1783	+ 11	+ 17	- 28	3372	- 51	+ 124	- 73
6	ICI "C"	149	121	+ 26	- 04	- 22	1789	+ 16	+ 17	- 33	3371	- 45	+ 124	- 79
7	$Macbeth_{6800K}$	147	123	+ 24	- 03	- 21	1792	+ 14	+ 19	- 33	3377	- 42	+ 122	- 80
8	$Planckian_{7000K}$	143	122	+ 25	- 03	- 22	1786	+ 17	+ 20	- 37	3383	- 44	+ 129	- 85
9	Gibson $1/\lambda^4$ (.1+.9)	143	120	+ 26	- 04	- 22	1785	+ 15	+ 20	- 35	3377	- 47	+ 129	- 82
10	Gibson $1/\lambda^4$ (.15+.85)	135	121	+ 27	- 03	- 24	1783	+ 17	+ 19	- 36	3378	- 43	+ 129	- 86
11	$Macbeth_{7500K}$	133	124	+ 24	- 01	- 23	1792	+ 17	+ 20	- 37	3375	- 37	+ 123	- 86
12	$Fluorescent_{7650K}$	131	127	+ 27	- 04	- 23	1790	+ 18	+ 23	- 41	3386	- 36	+ 127	- 91
13	$Planckian_{8000K}$	125	123	+ 26	- 02	- 24	1792	+ 17	+ 22	- 39	3383	- 38	+ 131	- 93
14	Gibson $1/\lambda^4$ (.2+.8)	125	121	+ 26	- 02	- 24	1782	+ 17	+ 22	- 39	3378	- 40	+ 131	- 91
15	Gibson $1/\lambda^4$ (.3+.7)	110	122	+ 25	- 01	- 26	1778	+ 16	+ 26	- 42	3379	- 35	+ 133	- 98
16	CO_2 (25mm)	110	122	+ 22	- 01	- 23	1774	+ 13	+ 25	- 38	3398	- 40	+ 133	- 93
17	$Fluorescent_{13000K}$	77	130	+ 21	- 05	- 26	1779	+ 19	+ 33	- 52	3391	- 20	+ 134	-114
18	Mercury lines of $Fluorescent_{7650K}$	Beyond 0	190	+ 12	+ 14	- 26	1842	+ 35	+ 85	-120	3492	+ 58	+ 154	- 212

a/ See text

Table 20. Mean differences, caused by changing from one to another of 17 illuminants, for reflectance (ICI - Y value) and chromaticity (in UCS units of r, g, and b) for 30 cotton colors. The standard deviation is shown with each mean [a]

µrd		208				165			
Illuminant		ICI "B"				Abbot Daylight			
Description	Approx. color temperature in µrd	Y	r	g	b	Y	r	g	b
		$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
ICI "B"	208					21 ± 4	+2169 ±10	- 842 ±16	-1328 ± 21
Abbot Daylight	165	21 ± 4	-2169 ±10	+ 842 ±16	+1328 ±21				
Carbon Arc	157	26 ± 5	-2741 ± 8	+ 1420 ± 22	+ 1321 ± 23	5 ± 1	+ 572 ± 6	+ 578 ± 7	+ 7 ± 3
$\text{Fluorescent}_{6500K}$	153	24 ± 4	-2751 ± 10	+ 945 ± 33	+ 1806 ± 33	3 ± 2	- 582 ± 8	+ 104 ± 18	+ 478 ± 12
ICI "C"	149	27 ± 5	-2883 ± 12	+ 804 ± 24	+ 2079 ± 32	5 ± 1	- 714 ± 4	- 38 ± 9	+ 752 ± 12
Macbeth_{6800K}	147	30 ± 5	-3261 ± 9	+ 1411 ± 30	+ 1850 ± 29	9 ± 1	-1091 ± 8	+ 570 ± 15	+ 522 ± 9
Planckian_{7000K}	143	32 ± 6	-3282 ± 11	+ 1159 ± 27	+ 2123 ± 34	11 ± 2	-1113 ± 3	+ 317 ± 12	+ 796 ± 14
Gibson $1/\lambda^4$ (.1+.9)	143	31 ± 6	-3124 ± 13	+ 985 ± 24	+ 2139 ± 33	10 ± 2	- 955 ± 4	+ 143 ± 9	+ 812 ± 13
Gibson $1/\lambda^4$ (.15+.85)	135	36 ± 7	-3585 ± 14	+ 1054 ± 28	+ 2531 ± 39	15 ± 3	-1416 ± 5	+ 213 ± 14	+1204 ± 18
Macbeth_{7500K}	133	36 ± 6	-3889 ± 11	+ 1436 ± 37	+ 2453 ± 39	15 ± 2	-1720 ± 7	+ 595 ± 22	+1126 ± 18
$\text{Fluorescent}_{7650K}$	131	37 ± 6	-3949 ± 12	+ 1233 ± 42	+ 2717 ± 43	15 ± 2	-1780 ± 7	+ 391 ± 27	+1388 ± 25
Planckian_{8000K}	125	42 ± 8	-4170 ± 13	+ 1334 ± 36	+ 2836 ± 44	20 ± 3	-2001 ± 5	+ 492 ± 21	+1509 ± 24
Gibson $1/\lambda^4$ (.2+.8)	125	41 ± 8	-4036 ± 15	+ 1122 ± 33	+ 2914 ± 44	20 ± 4	-1867 ± 7	+ 280 ± 18	+ 1586 ± 24
Gibson $1/\lambda^4$ (.3+.7)	110	50 ± 10	-4906 ±16	+ 1252 ± 41	+ 3654 ± 54	29 ± 5	-2737 ± 9	+ 411 ± 8	+ 2326 ± 33
CO_2 (25mm)	110	59 ± 12	-5638 ± 54	+ 2702 ± 41	+ 2926 ± 39	37 ± 7	-3459 ± 10	+ 1861 ± 27	+ 1598 ± 19
$\text{Fluorescent}_{13000K}$	77	66 ± 12	-6557 ± 16	+ 1808 ± 66	+ 4750 ± 69	44 ± 8	-4388 ± 13	+ 966 ± 52	+ 3422 ± 49
Mercury lines of $\text{Fluorescent}_{7650K}$	Beyond 0	75 ± 11	-11958 ±103	+ 3848 ±237	+ 8110 ±151	53 ± 8	-9789 ±108	+ 3006 ±223	+ 6782 ±133

µrd		157				153			
Illuminant		Carbon Arc				$\text{Fluorescent}_{6500K}$			
Description	Approx. color temperature in µrd	Y	r	g	b	Y	r	g	b
		$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$	$x10^{-5}$
ICI "B"	208	26 5	+2741 ±8	-1420 ±22	-1321 ±23	24 ± 4	+2751 ±10	- 945 ±33	-1806 ±33
Abbot Daylight	165	5 ± 1	- 572 ± 6	+ 578 ± 7	- 7 ± 3	3 ± 2	+ 582 ± 8	- 104 ± 18	- 478 ± 12
Carbon Arc	157					2 ± 2	+ 10 ± 4	+ 475 ± 11	- 485 ± 11
$\text{Fluorescent}_{6500K}$	153	2 ± 2	- 10 ± 4	- 475 ± 11	+ 485 ± 11				
ICI "C"	149	1 ± 1	- 142 ± 9	- 616 ± 3	+ 758 ± 10	3 ± 2	- 132 ± 10	- 141 ± 10	+ 274 ± 2
Macbeth_{6800K}	147	4 ± 1	- 520 ± 3	- 9 ± 8	+ 528 ± 7	6 ± 2	- 510 ± 2	+ 466 ± 4	+ 44 ± 4
Planckian_{7000K}	143	6 ± 1	- 541 ± 7	- 261 ± 5	+ 802 ± 12	8 ± 3	- 531 ± 7	+ 213 ± 7	+ 318 ± 3
Gibson $1/\lambda^4$ (.1+.9)	143	5 ± 1	- 383 ± 9	- 435 ± 2	+ 818 ± 11	7 ± 3	- 373 ± 10	+ 40 ± 10	+ 334 ± 2
Gibson $1/\lambda^4$ (.15+.85)	135	10 ± 2	- 845 ± 10	- 366 ± 6	+1211 ± 17	12 ± 4	- 834 ± 10	+ 109 ± 6	+ 726 ± 6
Macbeth_{7500K}	133	10 ± 1	-1149 ± 5	+ 16 ± 15	+1132 ± 16	12 ± 3	-1138 ± 3	+ 491 ± 6	+ 648 ± 6
$\text{Fluorescent}_{7650K}$	131	11 ± 1	-1208 ± 6	- 187 ± 20	+1395 ± 23	13 ± 3	-1198 ± 3	+ 288 ± 10	+ 910 ± 13
Planckian_{8000K}	125	15 ± 3	-1429 ± 8	- 86 ± 14	+1515 ± 21	18 ± 4	-1419 ± 8	+ 388 ± 6	+1031 ± 12
Gibson $1/\lambda^4$ (.2+.8)	125	15 ± 3	-1295 ±11	+ 298 ± 10	+1593 ± 22	17 ± 5	-1285 ±11	+ 177 ± 5	+1108 ±11
Gibson $1/\lambda^4$ (.3+.7)	110	24 ± 4	-2166 ±13	- 167 ± 20	+2333 ± 31	26 ± 6	-2156 ±13	+ 308 ± 11	+1848 ± 21
CO_2 (25mm)	110	33 ± 6	-2887 ± 5	+1282 ± 19	+1605 ± 17	35 ± 8	-2877 ± 4	+1757 ± 10	+1120 ± 8
$\text{Fluorescent}_{13000K}$	77	40 ± 7	-3816 ± 11	+ 388 ± 45	+3428 ± 47	42 ± 8	-3806 ± 8	+ 862 ± 34	+ 2944 ± 36
Mercury lines of $\text{Fluorescent}_{7650K}$	Beyond 0								

Table 20. Cont'd

μrd		149				147			
Illuminant		ICI "C"				Macbeth$_{6800K}$			
Description	Approx. color temperature in μrd	Y	r	g	b	Y	r	g	b
		x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}
ICI "B"	208	27 ± 5	+2883 ± 12	- 804 ±24	-2079 ±32	30 ± 5	+3261 ± 9	-1411 ±30	-1850 ±29
Abbot Daylight	165	5 ± 1	+ 714 ± 4	+ 38 ± 9	- 752 ±12	9 ± 1	+1091 ± 8	- 570 ±15	- 522 ± 9
Carbon Arc	157	1 ± 1	+ 142 ± 9	+ 616 ± 3	- 758 ±10	4 ± 1	+ 520 ± 3	9 ± 8	- 528 ± 7
Fluorescent$_{6500K}$	153	3 ± 2	+ 132 ±10	+ 141 ±10	- 274 ± 2	6 ± 2	+ 510 ± 2	- 466 ± 4	- 44 ± 4
ICI "C"	149					3 ± 1	+ 377 ±10	- 607 ± 7	+ 230 ± 3
Macbeth$_{6800K}$	147	3 ± 1	- 377 ±10	+ 607 ± 7	- 230 ± 3				
Planckian$_{7000K}$	143	5 ± 1	- 399 ± 4	+ 355 ± 5	+ 44 ± 3	2 ± 1	- 21 ± 7	- 253 ± 4	+ 274 ± 5
Gibson 1/λ^4 (.1+.9)	143	4 ± 1	- 241 ± 3	+ 181 ± 3	+ 60 ± 2	1 ± 1	+ 136 ±10	- 426 ± 6	+ 290 ± 4
Gibson 1/λ^4 (.15+.85)	135	9 ± 2	- 702 ± 4	+ 250 ± 6	+ 452 ± 7	6 ± 2	- 325 ±11	- 357 ± 3	+ 682 ± 9
Macbeth$_{7500K}$	133	9 ± 1	-1006 ± 9	+ 632 ±14	+ 374 ± 7	6 ± 1	- 629 ± 3	- 25 ± 7	+ 604 ± 9
Fluorescent$_{7650K}$	131	10 ± 1	-1066 ± 9	+ 429 ±19	+ 637 ±13	7 ± 1	- 688 ± 4	- 178 ±13	+ 866 ±16
Planckian$_{8000K}$	125	15 ± 3	-1287 ± 5	+ 530 ±13	+ 757 ±12	11 ± 3	- 909 ± 8	- 78 ± 7	+ 987 ±15
Gibson 1/λ^4 (.2+.8)	125	14 ± 3	-1152 ± 5	+ 318 ±10	+ 834 ±12	11 ± 3	- 775 ±12	- 289 ± 4	+1064 ±15
Gibson 1/λ^4 (.3+.7)	110	24 ± 5	-2023 ± 8	+ 449 ±19	+1574 ±22	20 ± 4	-1646 ±13	- 158 ±13	+1804 ±25
CO_2 (25mm)	110	32 ± 7	-2744 ±12	+1898 ±18	+ 846 ± 9	29 ± 6	-2367 ± 3	+1291 ±12	+1076 ±11
Fluorescent$_{13000K}$	77	39 ± 7	-3674 ±13	+1004 ±43	+2670 ±37	36 ± 7	-3296 ± 9	+ 396 ±37	+2900 ±40
Mercury lines of Fluorescent$_{7650K}$	Beyond 0	48 ± 8	-9075 ± 109	+3044 ±214	+6031 ±120				

μrd		143				143			
Illuminant		Planckian$_{7000K}$				Gibson 1/λ^4 (.1+.9)			
Description	Approx. color temperature in μrd	Y	r	g	b	Y	r	g	b
		x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}
ICI "B"	208	32 ± 6	+3282 ±11	-1159 ±27	-2123 ±34	31 ± 6	+3124 ±13	- 985 ±24	-2139 ±33
Abbot Daylight	165	11 ± 2	+1113 ± 3	- 317 ±12	- 796 ±14	10 ± 2	+ 955 ± 4	- 143 ± 9	- 812 ±13
Carbon Arc	157	6 ± 1	+ 541 ± 7	+ 261 ± 5	- 802 ±12	.5 ± 1	+ 383 ± 9	+ 435 ± 2	- 818 ±11
Fluorescent$_{6500K}$	153	8 ± 3	+ 531 ± 7	- 213 ± 7	- 318 ± 3	7 ± 3	+ 373 ±10	- 40 ±10	- 334 ± 2
ICI "C"	149	5 ± 1	+ 399 ± 4	- 355 ± 5	- 44 ± 3	4 ± 1	+ 241 ± 3	- 181 ± 3	- 60 ± 2
Macbeth$_{6800K}$	147	2 ± 1	+ 21 ± 7	+ 253 ± 4	- 274 ± 5	1 ± 1	- 136 ±10	+ 426 ± 6	- 290 ± 4
Planckian$_{7000K}$	143					1 ± 1	- 158 ± 3	+ 174 ± 4	- 16 ± 2
Gibson 1/λ^4 (.1+.9)	143	1 ± 1	+ 158 ± 3	- 174 ± 4	+ 16 ± 2				
Gibson 1/λ^4 (.15+.85)	135	4 + 1	- 304 + 4	- 104 + 1	+ 408 + 5	5 ± 1	- 461 ± 1	+ 69 ± 5	+ 392 ± 6
Macbeth$_{7500K}$	133	4 ± 1	- 608 ± 6	+ 278 ±10	+ 330 ± 5	5 ± 1	- 765 ± 9	+ 451 ±13	+ 314 ± 6
Fluorescent$_{7650K}$	131	5 ± 1	- 667 ± 6	+ 74 ±15	+ 593 ±11	6 ± 1	- 825 ± 8	+ 248 ±19	+ 577 ±12
Planckian$_{8000K}$	125	9 ± 2	- 888 ± 2	+ 175 ± 9	+ 713 ±10	10 ± 2	-1046 ± 3	+ 349 ±12	+ 697 ±11
Gibson 1/λ^4 (.2+.8)	125	9 ± 2	- 754 ± 5	- 37 ± 6	+ 791 ±10	10 ± 2	- 911 ± 3	+ 137 ±10	+ 774 ±11
Gibson 1/λ^4 (.3+.7)	110	18 ± 4	-1625 ± 7	+ 95 ±15	+1530 ±20	19 ± 4	-1782 ± 5	+ 268 ±18	+1514 ±21
CO_2 (25mm)	110	27 ± 6	-2346 ±10	+1544 ±14	+ 802 ± 6	28 ± 6	-2503 ±12	+1717 ±18	+ 786 ± 7
Fluorescent$_{13000K}$	77	34 ± 6	-3275 ±11	+ 649 ±39	+2626 ±35	35 ± 6	-3433 ±13	+ 823 ±43	+2610 ±36
Mercury lines of Fluorescent$_{7650K}$	Beyond 0	43 ± 8	-8676 ±107	+2689 ±210	+5987 ±118	44 ± 8	-8834 ±110	+2863 ±214	+5971 ±119

Table 20. Cont'd

µrd		135				133			
Illuminant		Gibson $1/\lambda^4$ (.15+.85)				Macbeth$_{7500K}$			
Description	Approx. color tempera-ture in µrd	Y	r	g	b	Y	r	g	b
		x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}
ICI "B"	208	36 ± 7	+3585 ± 14	-1054 ± 28	-2531 ± 39	36 ± 6	+3889 ± 11	-1436 ± 37	-2453 ± 39
Abbot Daylight	165	15 ± 3	+1416 ± 5	- 213 ± 14	-1204 ± 18	15 ± 2	+1720 ± 7	- 595 ± 22	-1126 ± 18
Carbon Arc	157	10 ± 2	+ 845 ± 10	+ 366 ± 6	-1211 ± 17	10 ± 1	+1149 ± 5	- 16 ± 15	-1132 ± 16
Fluorescent$_{6500K}$	153	12 ± 4	+ 834 ± 10	- 109 ± 6	- 726 ± 6	12 ± 3	+1138 ± 3	- 491 ± 6	- 648 ± 6
ICI "C"	149	9 ± 2	+ 702 ± 4	- 250 ± 6	- 452 ± 7	9 ± 1	+1006 ± 9	- 632 ± 14	- 374 ± 7
Macbeth$_{6800K}$	147	6 ± 2	+ 325 ± 11	+ 357 ± 3	- 682 ± 9	6 ± 1	+ 629 ± 3	- 25 ± 7	- 604 ± 9
Planckian$_{7000K}$	143	4 ± 1	+ 304 ± 4	+ 104 ± 1	- 408 ± 5	4 ± 1	+ 608 ± 6	- 278 ± 10	+ 330 ± 5
Gibson $1/\lambda^4$ (.1+.9)	143	5 ± 1	+ 461 ± 1	- 69 ± 5	- 392 ± 6	5 ± 1	+ 765 ± 9	- 451 ± 13	- 314 ± 6
Gibson $1/\lambda^4$ (.15+.85)	135		—	—	—	1 ± 1	+ 304 ± 9	- 382 ± 9	+ 78 ± 1
Macbeth$_{7500K}$	133	1 ± 1	- 304 ± 9	+ 382 ± 9	- 78 ± 1		—	—	—
Fluorescent$_{7650K}$	131	1 ± 1	- 364 ± 8	+ 179 ± 14	+ 185 ± 7	1 ± 1	- 60 ± 2	- 203 ± 6	+ 263 ± 7
Planckian$_{8000K}$	125	5 ± 1	- 584 ± 3	+ 280 ± 8	+ 305 ± 5	5 ± 2	- 281 ± 6	- 103 ± 3	+ 383 ± 6
Gibson $1/\lambda^4$ (.2+.8)	125	5 ± 1	- 450 ± 1	+ 68 ± 4	+ 383 ± 5	5 ± 2	- 146 ± 10	- 314 ± 5	+ 461 ± 5
Gibson $1/\lambda^4$ (.3+.7)	110	14 ± 3	-1321 ± 4	+ 198 ± 13	+1122 ± 15	14 ± 3	-1017 ± 11	- 183 ± 7	+1197 ± 19
CO_2 (25mm)	110	23 ± 5	-2042 ± 13	+1648 ± 13	+ 394 ± 3	23 ± 5	-1738 ± 5	+1266 ± 5	+ 472 ± 3
Fluorescent$_{13000K}$	77	30 ± 5	-2972 ± 13	+754 ± 38	+2218 ± 31	30 ± 6	-2668 ± 7	+ 371 ± 30	+2296 ± 31
Mercury lines of Fluorescent$_{7650K}$	Beyond 0	39 ± 8	-8373 ± 111	+2794 ± 209	+5579 ± 113				

µrd		131				125			
Illuminant		Fluorescent$_{7650K}$				Planckian$_{8000K}$			
Description	Approx. color tempera-ture in µrd	Y	r	g	b	Y	r	g	b
		x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}	x10^{-5}
ICI "B"	208	37 ± 6	+3949 ± 12	-1233 ± 42	-2717 ± 43	42 ± 8	+4170 ± 13	-1334 ± 36	-2836 ± 44
Abbot Daylight	165	15 ± 2	+1780 ± 7	- 391 ± 27	-1388 ± 25	20 ± 3	+2001 ± 5	- 492 ± 21	-1509 ± 24
Carbon Arc	157	11 ± 1	+1208 ± 6	+ 187 ± 20	-1395 ± 23	15 ± 3	+1429 ± 8	+ 86 ± 14	-1515 ± 21
Fluorescent$_{6500K}$	153	13 ± 3	+1198 ± 3	- 288 ± 10	- 910 ± 13	18 ± 4	+1419 ± 8	- 388 ± 6	-1031 ± 12
ICI "C"	149	10 ± 1	+1066 ± 9	- 429 ± 19	- 637 ± 13	15 ± 3	+1287 ± 5	- 530 ± 13	- 757 ± 12
Macbeth$_{6800K}$	147	7 ± 1	+ 688 ± 4	+ 178 ± 13	- 866 ± 16	11 ± 3	+ 909 ± 8	+ 78 ± 7	- 987 ± 15
Planckian$_{7000K}$	143	5 ± 1	+ 667 ± 6	- 74 ± 15	- 593 ± 11	9 ± 2	+ 888 ± 2	- 175 ± 9	- 713 ± 10
Gibson $1/\lambda^4$ (.1+.9)	143	6 ± 1	+ 825 ± 8	- 248 ± 19	- 577 ± 12	10 ± 2	+1046 ± 3	- 349 ± 12	- 697 ± 11
Gibson $1/\lambda^4$ (.15+.85)	135	1 ± 1	+ 364 ± 8	- 179 ± 14	- 185 ± 7	5 ± 1	+ 584 ± 3	- 280 ± 8	- 305 ± 5
Macbeth$_{7500K}$	133	1 ± 1	+ 60 ± 2	+ 203 ± 6	- 263 ± 7	5 ± 2	+ 281 ± 6	+ 103 ± 3	- 383 ± 6
Fluorescent$_{7650K}$	131		—	—	—	5 ± 2	+ 221 ± 6	+ 101 ± 7	+ 120 ± 2
Planckian$_{8000K}$	125	5 ± 2	- 221 ± 6	+ 101 ± 7	+ 120 ± 2	+	+—	—	—
Gibson $1/\lambda^4$ (.2+.8)	125	4 ± 2	- 87 ± 9	- 111 ± 10	+ 198 ± 2	1 ± 1	+ 134 ± 4	- 212 ± 3	+ 77 ± 1
Gibson $1/\lambda^4$ (.3+.7)	110	14 ± 4	- 957 ± 10	+ 19 ± 4	+ 938 ± 9	9 ± 2	- 737 ± 6	- 81 ± 6	+ 817 ± 10
CO_2 (25mm)	110	22 ± 6	-1679 ± 6	+1469 ± 3	+ 210 ± 7	17 ± 4	-1458 ± 10	+1369 ± 6	+ 89 ± 5
Fluorescent$_{13000K}$	77	29 ± 6	-2608 ± 7	+ 575 ± 25	+2034 ± 24	24 ± 5	-2387 ± 10	+ 474 ± 31	+1913 ± 25
Mercury lines of Fluorescent$_{7650K}$	Beyond 0					33 ± 7	-7788 ± 108	+2514 ± 202	+5274 ± 108

Table 20. Cont'd.

µrd		125				110			
Illuminant		Gibson $1/\lambda^4$ (.2+.8)				Gibson $1/\lambda^4$ (.3+.7)			
Description	Approx. color temperature in µrd	Y	r	g	b	Y	r	g	b
		$\times 10^{-5}$	$\times 10^{-5}$	$\times 10^{-5}$	$\times 10^{-5}$	$\times 10^{-5}$	$\times 10^{-5}$	$\times 10^{-5}$	$\times 10^{-5}$
ICI "B"	208	41 ± 8	+4036 ± 15	-1122 ± 33	-2914 ± 44	50 ± 10	+4906 ± 16	-1252 ± 41	-3654 ± 54
Abbot Daylight	165	20 ± 4	+1867 ± 7	- 280 ± 18	-1586 ± 24	29 ± 5	+2737 ± 9	- 411 ± 8	-2326 ± 33
Carbon Arc	157	15 ± 3	+1295 ± 11	- 298 ± 10	-1593 ± 22	24 ± 4	+2166 ± 13	167 ± 20	-2333 ± 31
Fluorescent$_{6500K}$	153	17 ± 5	+1285 ± 11	- 177 ± 5	-1108 ± 11	26 ± 6	+2156 ± 13	- 308 ± 11	-1848 ± 21
ICI "C"	149	14 ± 3	+1152 ± 5	- 318 ± 10	- 834 ± 12	24 ± 5	+2023 ± 8	- 449 ± 19	-1574 ± 22
Macbeth$_{6800K}$	147	11 ± 3	+ 775 ± 12	+ 289 ± 4	-1064 ± 15	20 ± 4	+1646 ± 13	+ 158 ± 13	-1804 ± 25
Planckian$_{7000K}$	143	9 ± 2	+ 754 ± 5	+ 37 ± 6	- 790 ± 10	18 ± 4	+1625 ± 7	- 95 ± 15	-1530 ± 20
Gibson $1/\lambda^4$ (.1+.9)	143	10 ± 2	+ 911 ± 3	- 137 ± 10	- 774 ± 11	19 ± 4	+1782 ± 5	- 268 ± 18	-1514 ± 21
Gibson $1/\lambda^4$ (.15+.85)	135	5 ± 1	+ 450 ± 1	- 68 ± 4	- 383 ± 5	14 ± 3	+1321 ± 4	- 198 ± 13	-1122 ± 15
Macbeth$_{7500K}$	133	5 ± 2	+ 146 ± 10	+ 314 ± 5	- 461 ± 5	14 ± 3	+1017 ± 11	+ 183 ± 7	-1197 ± 19
Fluorescent$_{7650K}$	131	4 ± 2	+ 87 ± 9	+ 111 ± 10	- 198 ± 2	14 ± 4	+ 957 ± 10	- 19 ± 4	- 938 ± 9
Planckian$_{8000K}$	125	1 ± 1	- 134 ± 4	+ 212 ± 3	- 77 ± 1	9 ± 2	+ 737 ± 6	+ 81 ± 6	- 817 ± 10
Gibson $1/\lambda^4$ (.2+.8)	125					9 ± 2	+ 870 ± 2	- 131 ± 9	- 740 ± 10
Gibson $1/\lambda^4$ (.3+.7)	110	9 ± 2	- 870 ± 2	+ 131 ± 9	+ 740 ± 10				
CO_2 (25mm)	110	18 ± 4	-1592 ± 14	+1580 ± 9	+ 12 ± 5	8 ± 2	- 721 ± 16	+1449 ± 4	- 728 ± 15
Fluorescent$_{13000K}$	77	25 ± 5	-2521 ± 13	+ 686 ± 34	+1836 ± 25	16 ± 3	-1651 ± 12	+ 555 ± 26	+1096 ± 16
Mercury lines of Fluorescent$_{7650K}$	Beyond 0	34 ± 8	-7922 ± 111	+ 2726 ± 205	+5196 ± 108	24 ± 8	-7052 ± 111	+2596 ± 196	+4456 ± 98

µrd		110				77			
Illuminant		CO_2 (25mm)				Fluorescent$_{13000K}$			
Description	Approx. color temperature in µrd	Y	r	g	b	Y	r	g	b
		$\times 10^{-5}$	$\times 10^{-5}$	$\times 10^{-5}$	$\times 10^{-5}$	$\times 10^{-5}$	$\times 10^{-5}$	$\times 10^{-5}$	$\times 10^{-5}$
ICI "B"	208	59 ± 12	+5638 ± 54	-2702 ± 41	-2926 ± 39	66 ± 12	+6557 ± 16	-1808 ± 66	-4750 ± 69
Abbot Daylight	165	37 ± 7	+3459 ± 10	-1861 ± 27	-1598 ± 19	44 ± 8	+4388 ± 13	- 966 ± 52	-3422 ± 49
Carbon Arc	157	33 ± 6	+2887 ± 5	-1282 ± 19	-1605 ± 17	40 ± 7	+3816 ± 11	- 388 ± 45	-3428 ± 47
Fluorescent$_{6500K}$	153	35 ± 8	+2877 ± 4	-1757 ± 10	-1120 ± 8	42 ± 8	+3806 ± 8	- 862 ± 34	-2944 ± 36
ICI "C"	149	32 ± 7	+2744 ± 12	-1898 ± 18	- 846 ± 9	39 ± 7	+3674 ± 13	-1004 ± 43	-2670 ± 37
Macbeth$_{6800K}$	147	29 ± 6	+2367 ± 3	-1291 ± 12	-1076 ± 11	36 ± 7	+3296 ± 9	- 396 ± 37	-2900 ± 40
Planckian$_{7000K}$	143	27 ± 6	+2346 ± 10	-1544 ± 14	- 802 ± 6	34 ± 6	+3275 ± 11	- 649 ± 39	-2626 ± 35
Gibson $1/\lambda^4$ (.1+.9)	143	28 ± 6	+2503 ± 12	-1717 ± 18	- 786 ± 7	35 ± 6	+3433 ± 13	- 823 ± 43	-2610 ± 36
Gibson $1/\lambda^4$ (.15+.85)	135	23 ± 5	+2042 ± 13	-1648 ± 13	- 394 ± 3	30 ± 5	+2972 ± 13	- 754 ± 38	-2218 ± 31
Macbeth$_{7500K}$	133	23 ± 5	+1738 ± 5	-1266 ± 5	- 472 ± 3	30 ± 6	+2668 ± 7	- 371 ± 30	-2296 ± 31
Fluorescent$_{7650K}$	131	22 ± 6	+1679 ± 6	-1469 ± 3	- 210 ± 7	29 ± 6	+2608 ± 7	- 575 ± 25	-2034 ± 24
Planckian 8000K	125	17 ± 4	+1458 ± 10	-1369 ± 6	- 89 ± 5	24 ± 5	+2387 ± 10	- 474 ± 31	-1913 ± 25
Gibson $1/\lambda^4$ (.2+.8)	125	18 ± 4	+1592 ± 14	-1580 ± 9	- 12 ± 5	25 ± 5	+2521 ± 13	- 686 ± 34	-1836 ± 25
Gibson $1/\lambda^4$ (.3+.7)	110	8 ± 2	+ 721 ± 16	-1449 ± 4	- 728 ± 15	16 ± 3	+1651 ± 12	- 555 ± 26	-1096 ± 16
CO_2 (25mm)	110					7 ± 3	+ 929 ± 8	895 ± 26	-1824 ± 30
Fluorescent$_{13000K}$	77	7 ± 3	- 929 ± 8	- 895 ± 26	1824 ± 30				
Mercury lines of Fluorescent$_{7650K}$	Beyond 0								

Table 20. Cont'd

µrd		Beyond 0			
Illuminant		Mercury lines of Fluorescent 7650K			
Description	Approx. color tempera-ture in µrd	Y $\times 10^{-5}$	r $\times 10^{-5}$	g $\times 10^{-5}$	b $\times 10^{-5}$
ICI "B"	208	75 ±11	+11958 ±103	-3848 ±237	-8110 ±151
Abbot Daylight	165	53 ± 8	+ 9789 ±108	-3006 ±223	-6783 ±132
Carbon Arc	157				
$\text{Fluorescent}_{7650K}$	153				
ICI "C"	149	48 ± 8	+ 9075 ±109	-3044 ±214	-6031 ±120
Macbeth_{6800K}	147				
Planckian_{7000K}	143	43 ± 8	+ 8676 ±107	-2689 ±210	-5987 ±118
Gibson $1/\lambda^4$ (.1+.9)	143	44 ± 8	+ 8834 ±110	-2863 ±214	-5971 ±119
Gibson $1/\lambda^4$ (.15+.85)	135	39 ± 8	+ 8373 ±111	-2794 ±209	-5579 ±113
Macbeth_{7500K}	133				
$\text{Fluorescent}_{7650K}$	131				
Planckian_{8000K}	125	33 ± 7	+ 7788 ±108	-2514 ±202	-5274 ±108
Gibson $1/\lambda^4$ (.2+.8)	125	34 ± 8	+ 7922 ±111	-2726 ±205	-5196 ±108
Gibson $1/\lambda^4$ (.3+.7)	110	24 ± 8	+ 7052 ±111	-2596 ±196	-4456 ± 98
CO_2 (25mm)	110				
$\text{Fluorescent}_{13000K}$	77				
Mercury lines of $\text{Fluorescent}_{7650K}$	Beyond 0				